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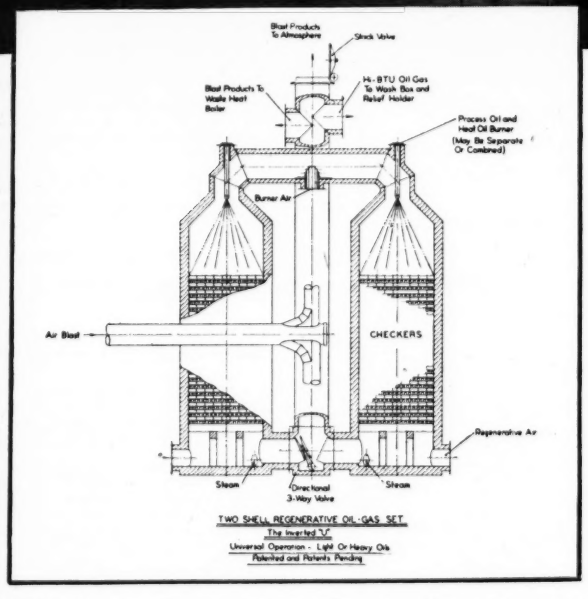

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GAS

• *28th Year of Publication*

DECEMBER 1952 • VOLUME XXVIII • NUMBER 12

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GAS is published monthly by Jenkins Publications, Inc., 198 South Alvarado Street, Los Angeles 4, California. Subscription price, United States and possessions (in advance), 50 cents per copy; one year, $2.00; two years, $3.00. All other countries: one year, $4.00; two years, $7.00. Acceptance under Section 34.64 P. L. & R. authorized. Member: The Controlled Circulation Audit, Inc.; National Business Publications, Inc. GAS is indexed regularly by Engineering Index Inc. Publishers: BUTANE-PROPANE NEWS; Handbook BUTANE-PROPANE GASES; BOTTLED GAS MANUAL; Annual BUTANE-PROPANE Catalog; WESTERN METALS. The name "GAS" is registered, U. S. Patent Office.

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thermally thinking

the editors

Effects of Republican Victory

Washington

IN THE SOBER STOCK-TAKING following the first jubilant outcry from a sizeable segment of the gas industry over the results of the general election, observers here feel that utilities in general and the natural gas industry in particular can be more optimistic about their future in this country.

The consensus among observers here is that the constant threat of federal harassment, and possible federal ownership, of some utilities virtually will be nil in the coming four years. The emphasis among the new men who will staff the Executive Branch and the leaders in Congress, generally, will be on better regulation, more harmonious utility-federal-government relations and, correspondingly, less emphasis on "share-the-wealth" through adoption or threat of policies that keep down profits in the gas and other utilities industries.

On the other hand, careful analysis of actual records of the Republicans who will be in key spots on Capitol Hill does not lead Washington observers to believe that the coming years will represent a "field day" for either the natural gas industry or utilities in general.

For instance, Sen. Charles W. Tobey (R.-N. H.) is slated to be chairman of the Senate Committee on Interstate and Foreign Commerce. He is noted more as a "liberal"—whatever that means—in Washington than he is for any desire to take the shackles off legitimate business. If there is a New Deal measure that Senator Tobey has not supported vigorously in the past eight years, notice of the fact has escaped the attention of reporters who keep up with such developments.

There are others in the Republican Senate and House of Representatives who, far from wanting to stop the encroachment of the federal government into new fields of business, particularly utility fields, are committed to gradualism—the process by means of which the socialists want to make over and take over America. One of these, for instance, is Sen.-elect Dwight Griswold (R.-Neb.), who is an ardent proponent of public ownership of utilities. There are others, as noted, in the Senate and in the House of Representatives, including Sen. Alexander Wiley (R.-Wisc.), another self-styled "liberal," and Sen. John Sherman Cooper (R.-Ky.), who owes more to the New Deal-Fair Deal than he can ever repay.

Some of the good points to the Republican victory, from the standpoint of the natural gas industry, would include:

1 — The certainty that Thomas Buchanan, the interim chairman of the Federal Power Commission, will no longer be in that post when the new Congress is seated. Buchanan failed to win Senate confirmation last spring when his name was sent to the Hill by President Truman, but the President gave him the interim appointment as soon as Congress went home.

2 — The men who generally will be in control, in the White House, the various agencies, or on Capitol Hill, will not be committed in advance to a hatred of utilities. For some years, it has been a matter of record, the outgoing administration has kept much of its support among the "peepul" by railing against the "interests," which seemed to include anyone or any group that could pay its bills on time. Now, with a new group of men taking over who are not committed to hate "the interests," is is widely believed that these new men undoubtedly will give a fairer shake to the natural gas industry, to utilities, and, indeed, to all business.

On Capitol Hill, it is expected that the so-called "tidelands oil" bill that was vetoed by President Harry Truman will be re-enacted, and, this time, will be signed by the new President.

Rep. John W. Heselton (R.-Mass.), who won reelection handily, is expected to re-introduce his bill, which died in committee, to set up federal standards, under FPC supervision, for pipeline construction as a safety measure.

Rep. Charles W. Wolverton (R.-N. Y.), a very levelheaded Republican, will be chairman of the House Committee on Interstate Commerce, replacing Rep. Charles Crosser (D.-O.), who has been an ardent New Dealer for many years.

OPS Blocks Escalator Clauses

UNDER OPS' new amendment 8 to CPR 17, the worst fears of gas producers—the complete elimination of escalator clauses—failed to materialize, but the limitations placed upon their use and upon the functioning of "favored nations" clauses can hardly be expected to improve their feelings toward the "pipeline monopoly." Although

not of their making, the amendment does give the pipeline companies a rather convenient dodge, and may loosen the cost-rate squeeze here and there; but it's doubtful that any of them will welcome it.

The directive permits escalator clauses to become effective, but only in contracts executed prior to or during the base period ending Jan. 25, 1951. But the favored nation clause, whereby buyers who pay an increased price to one seller bind themselves to pay an increased price to all other sellers whose contracts contain the provision, is operable only if its use won't result in piercing the "general area" ceiling. In effect, then, permissible price escalation cannot establish new and higher ceiling prices.

In-lining, the practice of boosting prices to bring them into line with those of other sellers whose prices may be increased pursuant to state minimum price regulations, is also prohibited. "While OPS is required to recognize such minimum prices as ceilings under section 402 (1) of the Defense Production Act," reads the amendment, "it need not and should not give the regulations or orders establishing minimum prices greater scope than the state itself does."

Thinking behind the imposition of the base period deadline is that, since "the large scale financing of gas production and interstate pipelines was based in some measure on contracts calling for initially low prices subject to escalation . . . fairness to both buyers and sellers and stability in the industry make it desirable to continue to permit the unfettered operation of such of those contracts as were executed prior to the imposition of price control."

How long the amendment will remain in force is moot. Director Tighe Woods is likely to be job hunting soon after Jan. 20. OPS might possibly expire in April, when DPA's price provisions come up for consideration. There's been considerable talk in Washington about all sorts of decontrolling.

Meanwhile, before its enactment, producers had already threatened to carry the Woodlawn field decision (*GAS*, October, p. 58) to the courts.

Whatever happens, OPS will have scored another point in its role as "champion of the consumer," which is about all its present staff can expect to accomplish now that the election is past.

PR Program Making Progress

AGA'S PROPOSED public relations program is making strides, and not too long after Jan. 1 it may be ready for submission for association approval. Judging from preliminary reports, it looks quite good; but there's one phase of it that looms as a particularly tough nut to crack. That's the "local level" side of the program, and it's the one that seems, in the end, to be the most vital. All business, the saying goes, is local.

One question that's sure to arise, and frequently, is whether the local level knows what the national level is up to. At present, in many instances it doesn't. Chicago, Dallas, and Pittsburgh might know pretty well what's cooking at AGA headquarters, but Suffolk, Lawrence, and Amarillo may very well not.

This fact was clearly demonstrated during the recent meetings of the special AGA committee on problems of smaller gas companies. The committee met, made four general recommendations as to things the AGA should do for smaller companies, and then wound the whole thing up with the conclusion that, to quote Chairman W. L. Woodward of Alva, Okla., "Of the four recommendations we are submitting, our committee found that AGA had the situation pretty well in hand and probably nothing else can be done."

"Many of the smaller companies," concluded Mr. Woodward, "do not realize the vast amount of information that is available in the [AGA] office." Information on promotion programs, cooperative advertising schemes, standards requirements, safety, and many other topics has not percolated down to the so-called grass roots. There's nothing wrong, apparently, with AGA's mailing machines. It's simply that, in such a complex business as this one, it's a full time job just keeping track of what's brewing in committees and staff meetings.

The tremendous stacking of committees upon committees was brought out in E. H. Eacker's talk before the AGA convention. Said the AGA vice president: "The AGA has 17 different committees giving study to its safety and accident prevention program. Complementing these are 16 subcommittees of the accident prevention committee and 23 subcommittees of the approval requirements committee. That is a total of 56 major and subgroups."

What he was leading up to was the question of why, with all these groups working on the problem, we stand 32nd in accident frequency rate and 24th in severity rate out of 40 industries. The answer might be that, if these 56 groups have come up with the magic answers, too few smaller companies are aware of it. It's a known fact that the smaller the company the worse is its safety record.

On Oct. 24 the AGA executive board voted to retain the smaller companies group as a standing committee, to act in a "watchdog" or sort of liaison capacity. It has its work cut out for it, as does the staff.

technical trends

by guy corfield

Sampling Gases and Liquids

It is rather obvious that the purpose of taking a sample of gas or liquid is to obtain information, by subsequent analysis or test or observation, on the flowing stream or stored bulk of gas or liquid from which the sample is removed. As the late V. J. Altieri so aptly expressed it in his manual on "Gas Analysis," published in 1945 by AGA, "Sampling is . . . the art [note that it is given the status of an art] of obtaining a part for inspection or test to provide evidence of the quality of the whole."

It is also obvious, although the fact is sometimes overlooked, that the information provided by the analysis or test can only be as dependable and accurate as the sample is representative, uncontaminated and undeteriorated, i. e., the most careful analysis or test cannot give correct information if the sample has not been taken, transported, and stored properly.

The sampling of gases and volatile hydrocarbon liquids, as opposed to non-volatile liquids and solids, presents some unusual problems to the gas industry technician. Gases may be under very high pressure or they may be under vacuum; they may be wet with either water or liquid hydrocarbons, and the problem of taking a wet sample that will be representative of both the gas and liquid contents of the line in which it is flowing is at times almost insurmountable; other gases will contain corrosive or soluble constituents that may be removed by or dissolved in normal sampling apparatus, so that special equipment is often essential. Or it may be necessary to avoid sample tubing and containers entirely and introduce the sample direct into portable testing apparatus.

Volatile liquids such as propane and butane will expand to gases unless kept under careful volume, pressure and temperature restraint, and when gasifying may distill, so that the gas and liquid portions may both have compositions different from the original liquid. Furthermore, the handling of inflammable hydrocarbons under pressure dictates adequate safety precautions against loss, damage, and accident. In the overall picture, the importance of samples and sampling can hardly be overestimated, and all procedures and practices should receive very careful initial and periodic review to be sure that the sample when tested truly represents the bulk from which it is taken and that it will provide the information required.

Bulletins and manuals devoted to the several phases of sampling of gaseous and liquid hydrocarbons have been issued by several technical organizations, including American Society for Testing Materials, American Petroleum Institute, the Natural Gasoline Assn. of America, and the California Natural Gasoline Assn. Most of the items have been covered with varying degrees of completeness. California Natural Gasoline Assn. is embarking on a program of revision and extension of its Bulletin TS-342, "Tentative Standard Procedure for Sampling Natural Gas and Gasoline," along the lines of correlation with comparable bulletins of related organizations, review of sample containers with respect to functional use and safety, expansion of data on gases and natural gasoline, segregation of methods for L.P. gas, inclusion of methods for lean and rich oil and crude oil, and development of special instructions and precautions to assist the field and laboratory technicians in the practical aspects of accurate and safe techniques. The availability of this revised bulletin will be awaited with interest by the many gas industry technical people.

Copper-Clad Steel

LUKENS STEEL CO., Coatesville, Pa., has announced the production and availability of copper-clad steel plate, consisting of a layer of copper bonded to one side of the steel. This product is made by heating and rolling the steel and copper sheet together so that they are uniformly and permanently bonded to each other. The layer of copper is available at 10, 15 or 20% of the total plate thickness, in plate sizes up to 120 in. wide, 380 in. long, and 3/16 to 1¼ in. total thickness; flanged only, or flanged and dished heads are also available. Several grades of copper or copper alloy, and all the regular grades of plain carbon or alloy steel, are obtainable. Assertedly this copper sheet can be sheared, formed or rolled according to standard procedures.

This product should be of interest to the gas industry for possible fabrication of hot water heater tanks, heat exchangers, and other assemblies.

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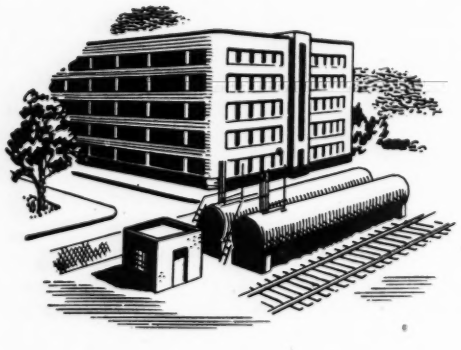

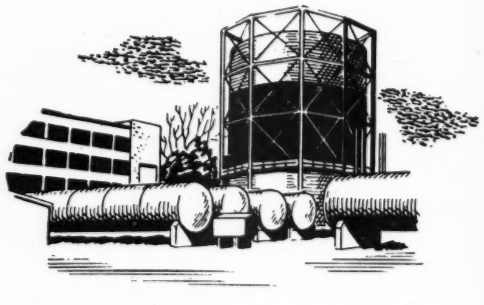

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Excess Public Liability Insurance And the Gas Industry

By H. P. STELLWAGEN
Indemnity Insurance Co. of North America
Philadelphia

Gas companies are finding it increasingly difficult to get excess liability insurance. Have the casualty companies lost confidence in the gas industry?

THE regular run of public liability policies cover from the ground up; that is to say, they pay all losses from the smallest to the largest, whether such losses be $5, $50, $500 or whatever. Most of the larger gas companies, however, like the big oil companies and the larger manufacturers, feel that they do not need protection against small losses. They are perfectly able to pay modest losses and see no use in paying the rather sizeable premiums which contemplate the payment of such losses. Then, too, many public utility companies prefer to settle small claims made against them with more regard to public relations than to the strict application of the principles of legal responsibility.

What these large companies really want is protection against catastrophe—reimbursement for the large loss that, when it comes, may affect their cash position and even affect the return to their stockholders. Therefore, they seek to purchase what is known as excess-of-loss liability insurance, which indemnifies the policyholder for loss in excess of a stated amount arising from any one accident. The amount over which the insurance applies is known as the policyholder's retention and the amount of this retention will vary with the size and financial position of individual policyholders. Some gas companies feel that they can safely bear a first loss of $25,000 as the result of any one accident and believe further that they can bear such loss two or three times in the course of a year. Others have decided that they can well afford to absorb the first $50,000 of any one loss. I have heard one gas executive say that, if his company bore the first $100,000 of any one loss and if it were unfortunate enough to have three such losses in the course of a year, his company's earnings per share of common stock would not be affected by more than a few cents per annum.

The law books report a wealth of cases illustrative of the application of the law of negligence to gas companies. Generally speaking, the law holds them accountable for the exercise of that degree of care that is consistent with the nature of their operations. Thus, the gas company owes a duty to its customers and to the public in general not only to install its distribution facilities properly but also to maintain them properly. The company is under obligation from time to time to make reasonable checks as to the condition of pipes and to maintain adequate records indicating the length of time in which normal deterioration will create a hazardous condition. Pipes may not be installed underground and then ignored completely. In most jurisdictions where change is made from manufactured to natural gas, there is a duty imposed upon the company either to adjust the customer's equipment or, at the very least, to give adequate warning to the customer that such adjustment is necessary because of the differences in burning characteristics of natural gas. Because of the dangerous nature of the instrumentality, convincing evidence of contributory negligence is necessary to bar the plaintiff from recovery, particularly where there is some evidence of negligence on the part of the gas company. As might be expected, the evidence to support negligence of the company is frequently slight and need not be detailed and accurate.

And now, the core of the problem. Members of the gas industry recognize the need for liability insurance and for many years have purchased such insurance on an excess-of-loss basis from various insurance companies, both here and abroad. During the last 12 months, however, the gas companies have found it increasingly difficult to purchase such insurance from admitted American casualty insurance companies. Certain companies, which formerly provided this insurance, have ceased writing it. In the case of my own company, which for many years provided such insurance in the large amounts requested, it has been found necessary to limit policies to $500,000, although I realize that amount is insufficient for those who believe that $1 million or $2 million or even more is necessary to their peace of mind. Many gas companies have been obliged, consequently, to go to foreign markets for part or all of their excess liability insurance requirements.

No one likes to be deprived of freedom of choice and I know that many gas executives deplore the absence of an American insurance market wide enough

This paper was presented at the AGA convention in Atlantic City, Oct. 27-30.

to meet their requirements. How did this happen? Has the casualty insurance industry lost confidence in the gas industry?

I can give you a categorical answer to that one quickly. The answer is, "Certainly not." The gas industry and the insurance companies are close partners in the free enterprise system of America. Many gas companies have looked to insurance companies for financing and

many insurance companies have taken up large parts of gas bond and preferred stock issues. But I would emphasize even more strongly the interest of insurance companies in gas equities. Look over the list of common stockholders and I am sure you will find that American stock fire and casualty companies are prominent among the owners of substantial blocks of gas company shares. The companies with which I am connected owned as of June 30, 1952, 1,064,635 shares of public utility companies, all of which are engaged in the gas business in varying degree, with a market value of $32,308,895. In addition, my companies owned 408,464 shares in natural gas companies with a market value of $18,064,403. In other words, the companies that I represent had more than $50 million worth of confidence in the gas business of America. Let me emphasize that these figures apply only to the three companies in the North American Group with which I am connected. These figures are repeated in varying degree for at least a score or more of other companies so that the total investment of my industry in the gas industry is truly tremendous. Obviously, we wish gasmen well, we hope they continue to make money, and it is our natural inclination to meet their every insurance need. I do not think I am presumptuous in suggesting that gas companies should prefer to look to the part-owners of their enterprises for insurance requirements rather than to some alien organization without such ownership interest.

And so we come back to the question, Why is there a dearth of American market for excess insurance for gas companies? I believe I can answer that question by giving briefly and in non-technical language a few of the principles upon which the insurance business operates.

The premiums that we charge for insurance must do three things: they must cover the losses produced by the risks assumed, they must pay our expenses, and they must yield a profit. The major part of the premium is allocated to the payment of losses and to the cost of investigating and settling claims and the defense of law suits. The expense element of the premium covers a variety of things. It covers commissions payable to agents and to brokers who bring your business to us and negotiate it with us. It covers taxes on premiums levied by the several states. It must be adequate to include the cost of maintaining the company's home office and branch offices, its inspectors, engineers, payroll auditors, and general managerial personnel. Lastly, it must cover all our voluminous accounting and statistical work, much of which is required of us, as it is for you, by public authority.

What is left after paying all losses and expenses is called "underwriting profit." It may be surprising to know that until recently casualty insurance rates have been so calculated as to produce an underwriting profit of 2.5% and that they have actually yielded far less. Today the casualty insurance industry, faced with underwriting losses and a federal income tax rate of 52% on any profits it is fortunate enough to make, is contending for approval by public regulatory authorities of the inclusion in the rate-making formula of a factor of 5% for profits and contingencies.

Expense Element

The expense element in the premium rate varies by line of business and by the kind of risk undertaken. In the boiler and machinery field, the major part of the premium dollar is spent by insurance companies in preventing boiler explosions. Similarly, an important element of the premium dollar charged for elevator liability insurance is spent by insurance companies in preventing elevators from falling. Nobody wants a boiler to blow up and nobody wants an elevator to fall down. And so the loss element in the rate in both cases is the smaller and the less important element of the premium.

It is not possible to say with too much accuracy how the premium dollar is divided on the average for all lines of casualty insurance, but it is somewhat near the fact to say that out of every dollar 60 cents is available for losses and loss expense, and 40 cents for all over-

head including profit. In the case of excess liability insurance, the expense factor is smaller and the loss factor, accordingly greater. This is because agents and brokers agree that the rate of commission payable on such business should be less than the rate payable on average business and also because the factor for certain general administrative expenses is proportionately less than in the case of normal business. The point I am trying to make is that the measure of an insurance company's profit is not the difference between premiums collected and losses paid. Losses represent only the manufacturing cost of our product. We, like other businesses, incur costs for selling, servicing, and handling our business and these must all be taken into account in computing our rate of profit. The truth is that, even under the best of auspices, the casualty insurance industry seldom makes a profit of more than 2½% and last year and this year the business is operating with a serious underwriting loss.

While speaking of underwriting profit, let me make the further point that with excess liability insurance there is either feast or famine—either absence of loss or a catastrophe loss of crushing proportion. Knowing this, the underwriter cannot observe his record on a single risk for a single year and say that he has made a profit or a loss. If there has been no loss, he must reserve the bulk of the premium remaining to him so that he can be prepared to pay the large loss when it comes.

I should like to mention one other principle that has particular application to excess liability business. I refer to coinsurance and reinsurance. Insurance operates on the law of averages and the law of averages works only with large numbers of homogeneous risks. In the automobile field, for example, involving

as it does hundreds of thousands of similar units, it is possible to measure from past records how many cars out of 100 will have an accident in a year's time. It is also possible to arrive at some idea of the average cost of those accidents. There is a big volume of automobile business available and the underwriter with a good spread of such business has a pretty good idea of the result he may expect.

Law of Averages

In a field where the number of risks is small or where the amount of exposure to loss varies greatly from risk to risk, the law of averages begins to act erratically. Let us assume that with a certain type of risk, five losses may be expected in the course of a year out of a hundred risks insured. An underwriter may insure 10 such risks and might very well find to his dismay that his risks realized the full expectancy of five losses. Or assume that out of 100 risks, one might be expected to produce an extremely serious loss in the course of a year. Again the underwriter with a limited spread might find that one serious loss just happened to occur among the few which he has insured. In such cases, the underwriter manufactures a spread by coinsuring or reinsuring his risks with other insurance companies. Generally he will seek to limit his loss per risk so that, if he should become the victim of the perverse operation of the law of averages, he will avoid a crushing underwriting loss. This is a necessary procedure in the case of gas risks, oil risks, and others that are relatively few in number and that individually present a large loss potential. The original underwriter of such risks must reinsure them with a number of companies so that, if a large loss occurs, it will be spread over many companies and will not be concentrated in one company.

Let me re-state these two principles. The first is that rates must be adequate to cover losses and expenses and yield a profit. The second is that reinsurance is essential to the underwriting of risks that are limited in number and that are characterized by heavy loss potentialities. I emphasize these two principles because it was their failure to operate in the case of the gas business that brought about the current restriction of the American market for excess liability insurance.

A little over a year ago it became abundantly clear that the premium income available to interested underwriters was insufficient to cover losses and expenses. Indeed, an underwriting loss of serious proportions had already developed. Then, and because of the underwriting loss, the reinsurance market collapsed.

Like other crises, this one did not develop overnight. For many years the gas business had been profitable. Under the prodding of competition, insurance rates gradually worked their way downward. Insurance companies offered higher and higher limits of coverage and were persuaded to permit the policyholder to reduce his retention. Everybody was content with the situation, too content as it later turned out.

Soon after the close of the war, a change began to take place—a change that at first was hardly noticeable. Inflation was at work and it soon became apparent that a personal injury case that once was fairly settled for $10,000 was costing $25,000 or $50,000 and frequently even more. Meanwhile, the gas industry was expanding quickly and vigorously. According to AGA figures, $5.1 billion was spent for expansion in the period 1947 to 1951 and I understand that an expenditure of $5.6 billion is contemplated through 1956.

About five years ago there began to occur in different parts of the country some rather serious gas explosions and the frequency of these occurrences began to build up in 1950 and 1951. The sum total of losses resulting from these accidents was so large as to wipe out the profits of the previous decade and produce a heavy loss on the business currently on the books of the American casualty companies. In the summer and fall of 1951 a chain reaction set in. Insurance Company A cancelled its reinsurance of Company B. Company B served notice it could no longer share in the risks written by Company C, and so on. Some companies quit the business altogether. My own company lost its reinsurance and was compelled, as a matter of self-preservation, to reduce the limits of liability it had hitherto offered its policyholders. The end-result was the curtailment of the American market for excess liability insurance.

How, then, can an adequate American market be reconstituted on a base sufficiently broad to meet the gas industry's requirements? The present position of the casualty insurance business is not propitious for an immediate or an early resumption of the underwriting of the gas business by many of the companies that have recently retired from that field. Last year the countrywide record of capital stock casualty companies entered in the state of New York showed an underwriting loss of $91,307,000 on premium writings of $2,479,640,000. The major part of this loss arose from the automobile bodily injury and property damage liability business, but other liability insurance and workmen's compensation insurance were also unprofitable. It is believed that the results for the current year will be no better than those of last year and some underwriters fear they may be worse. While these losses are being incurred, the volume of business is steadily increasing and some underwriters are finding that their capacity for the absorption of additional business is practically depleted. Under circumstances such as these, the spirit of adventure is blunted and there is no enthusiasm for tackling new problems until the present ones are solved.

Recurring Cycles

However that may be, the casualty insurance business has gone through these cycles before and I am sure that the time will come again, and not too far off, when more American companies will turn their attention to the gas business. I am also certain that, if an adequate American market for this business is to be established, it will be established only by virtue of the closest cooperation between the gas industry and the casualty industry. I would, accordingly, suggest three areas where cooperation seems essential.

In the first place, it is necessary to face the fact that the gas industry must pay for its own losses. Acceptance of that proposition implies acceptance of its corollary—that the rates for excess liability insurance must be increased. Insurance rates must not only reflect current loss levels but they must also anticipate future loss levels. Liability losses are deferred losses and in many cases cannot be settled until considerable time has elapsed from the date of the accident

that caused them. It would be imprudent to assume that damage awards a year hence will be less than the awards of today. Rates must keep pace with the trend.

May I also say that there should be recognition of the fact that admitted tax-paying companies must charge rates above non-admitted non-tax-paying companies. It is to be questioned whether the situation will be helped in the long run if the purchase of insurance is controlled by the rather small savings that this situation creates.

The necessity for higher rates may not appeal too strongly to those gas companies that have had no losses in recent years. I can only repeat to them that insurance rests upon the principle that the many must pay for the losses of the few and that those fortunate enough not to have accidents must pay their pro rata share of the total bill.

Higher Retentions

Secondly, I think the gas industry must accommodate itself to higher retentions. A policy covering a loss in excess of $10,000 or even in excess of $20,000 is no longer a true excess policy. Injury to a single person or damage to a single house will more often than not exceed such a retention and invade the excess cover. Whenever the excess cover is called upon to contribute to relatively minor losses, it becomes increasingly difficult to underwrite it except at a very high premium. It must be remembered that true excess liability insurance must be bought and sold as catastrophe insurance and not as contributory primary insurance.

To those companies who feel unable to bear at least the first $25,000 of any one loss, I would suggest the purchase of primary insurance for as large a limit as the market will afford. There is, I believe, some market for such insurance. The purchaser of such primary insurance may then with better success seek excess insurance that will attach on a per accident basis after the primary insurance has been exhausted.

In the third place, we must cooperate to reduce the number and severity of accidents. Should we be able to realize the Utopian goal of the complete elimination of accidents, then the difficulties to which I have previously referred fall to the ground. I am aware of the fact that considerable safety work including the preparation of safety codes has been done by the AGA and by gas companies individually, but I hope you will not take it amiss if I suggest that even more can and should be done.

Some months ago our safety specialists investigated the gas company accidents reported to us in the last two years in order to determine conditions antecedent to their occurrence. It was found that there was a considerable number of accidents arising from gas line breaks owing to earth movements caused by frost, vibration, overhead pressure, settling of buildings, and other conditions. Aside from such cases, however, there were certain serious losses directly attributable to the following conditions:

Failure to test new lines before putting them into operation.

Failure to maintain a regular inspection program.

Failure to protect mains endangered by operations of other contractors.

Influenced by the findings of this analysis which, admittedly, was more general than scientific in character, we developed a comprehensive questionnaire designed to reveal all the facts related to the ownership and operation of a gas utility company. We asked our safety specialists to have this questionnaire completed through interviews and the observation of practices at the home offices of those risks now on our books. While our analysis of these questionnaires is not yet complete, some of the facts that it has thus far disclosed might be of interest.

No Relief Valves

In 14 instances excess pressure relief valves were not provided on the downstream side of regulators. In nine instances there was lack of adequate inspection service on gasholders. In seven instances there was no provision for inspection for leaks through the use of explosimeter and vegetation surveys. In four cases the company lacked an up-to-date map of its system showing pipe replacements and location of customers' service lines. Again there was failure in four cases to provide what was considered to be adequate odorization of the gas. In three cases no provision was made for cooperation with the city authorities in respect of notification of proposed excavation and construction work which might damage gas mains. Finally, there were two cases in which there was no provision for testing mains laid by private contractors before those mains were placed into service.

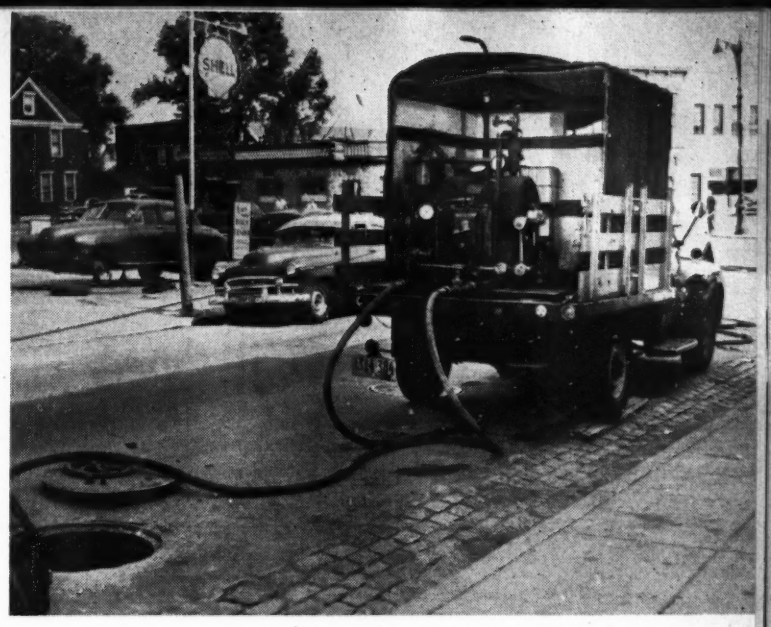
Certain of the deficiencies that our questionnaire developed have, as a matter of record, caused serious losses in the past. It must be assumed that failure to install the proper safeguards and inspection service will cause like accidents in the future.

I believe that much may be accomplished by cooperation between our industries. I have tried to tell you something about the insurance business and some of the principles upon which it operates, in the hope that you may have a better appreciation of our objectives and our problems. We, in turn, want to know more about your business because with knowledge comes understanding. In that connection, may I urge you to take the initiative in telling us about your business, the new developments in it, and your progress with safety codes and standards. Many of you are directors of insurance companies. Talk to the management of the insurance company on whose board you serve, explain your problems, and state your needs. You will find a ready response from the insurance companies, both individually and collectively. Remember that insurance underwriting is based on information. Who better than you can provide the underwriter with the true, up-to-date data that he needs for the intelligent appraisal of the gas business?

False Economy

I realize that your industry is contending with the problem of higher taxes and advancing operating costs and that you are pursuing every proper means of controlling your expenses. Will you permit me to suggest that it would be false economy to curtail your loss prevention activities? In the long run, insurance companies cannot pay losses arising from accidents that might reasonably have been prevented. You, likewise, cannot afford to dissipate your retentions in the payment of such losses. Insurance can and will compensate for the results of those fortuitous and unforeseeable happenings that occasionally defeat man's best effort to prevent them. By eliminating preventable accidents, you will hasten the restoration of a free insurance market and, what is of far greater importance to you, you will gain and keep the good-will of the public whom you serve. So, I urge you to keep your inspection service and your safety activities at top efficiency.

Cooperation is a two-sided affair. Upon us, the insurance companies, rests the responsibility of furnishing protection to American business. We want to discharge that responsibility to the gas industry. With your help, I feel confident that we will.



This portable fogger was used during conversion for fogging areas not covered by main station foggers.

Brooklyn Union Installs Permanent Oil Foggers

IN its $25 million conversion, completed on August 27, the Brooklyn Union Gas Co. was faced with many problems other than the adjustment of its customers' appliances. One of the most important was the effect of introducing bone-dry natural gas into an underground network of pipes that had been used in manufactured gas service for more than a half century.

The natural gas is dehydrated in Texas before being piped east in order to prevent any interruption of service from plugging of the pipeline or valves caused by the formation of gas hydrates. As a result, at the low pressures at which gas is distributed, natural gas has a relative humidity of less than 2% indicating its great affinity for moisture. Because a manufactured gas pipeline system is coated internally with tarry and oily deposits, it is necessary when introducing natural gas to add oil and/or moisture to the gas to prevent the drying out and movement of these deposits.

Early in 1951, before the big conversion was even started, Brooklyn Union installed four high-capacity Blaw-Knox Electroil foggers at its main distribution points to add oil to the gas in the form of a very fine fog. By sending oil through the mains as a fine suspension in the gas, it was possible to get oil into the gas lines of this complicated underground grid. As the gas traveled through the pipes, oil gradually deposited out on the inner surfaces, soaking the deposits and forming an oil film. The fog was found to travel distances up to 25 miles from the point of injection.

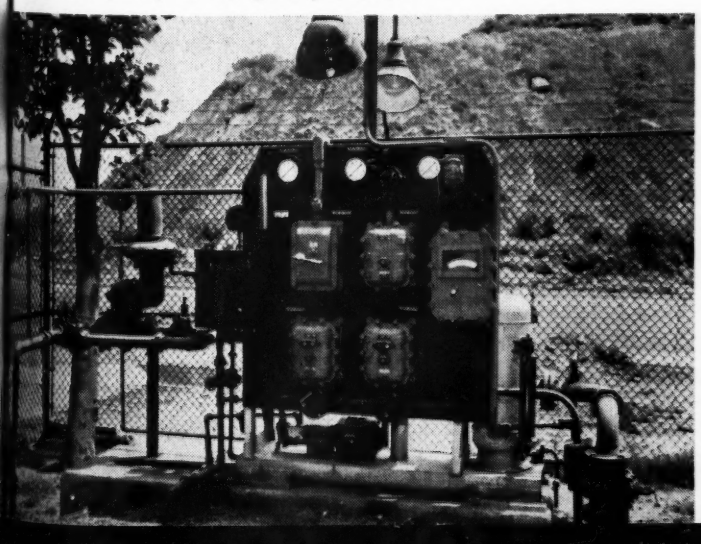
The fine oil fog produced by the Blaw-Knox equipment is accomplished through a process similar to nature's method of producing a water fog. In this equipment the oil is completely vaporized and the vapor then contacted with a stream of cold gas. The rapid chilling of oil vapor by the cold gas causes the oil to condense to fine fog particles suspended in the gas stream. Because the equipment must necessarily be installed on gas company property, all heating units are of explosion-proof design.

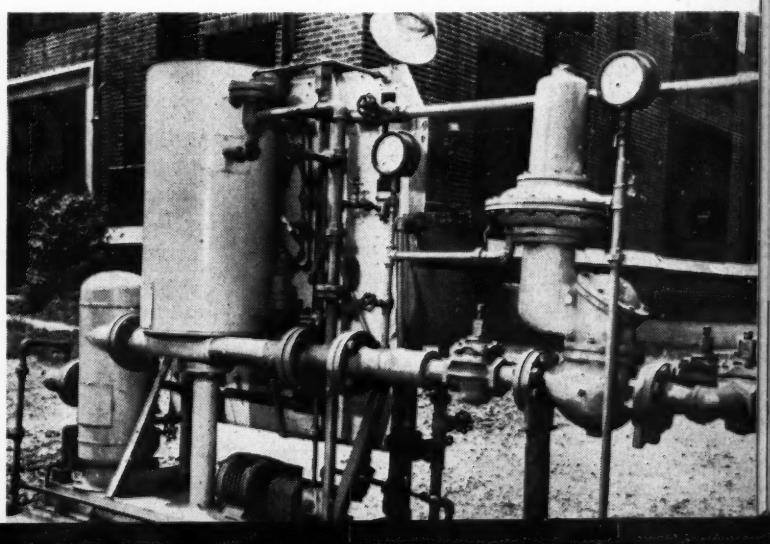
During the conversion of individual districts, the fog from the main distribution points was supplemented locally by use of a smaller portable fogger, also manufactured by Blaw-Knox. This unit was truck-mounted and equipped with a portable electric generator that supplied the necessary electrical heat requirement. By adding oil fog to each individual district as the conversion progressed, Brooklyn Union was assured that every line below the ground was adequately treated.

There were other things to be accomplished by fogging other than keeping the tarry deposits in place. Since the distribution grid contains a large percentage of cast iron pipe joined by bell and spigot-type joints, fogging keeps the packing in these joints from drying out. With the addition of odorant to the gas, it prevents absorption of odorant by the pipeline deposits and maintains uniform odor intensity. It is also imperative that meter diaphragm leathers made for manufactured gas be kept in an oil-moist condition to insure their proper functioning.

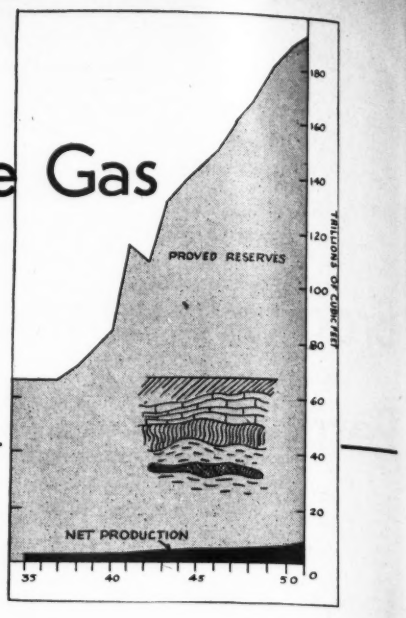
The results of oil fogging at Brooklyn Union have been excellent. Fogging before conversion has put the entire system in condition through the soaking of internal pipe surfaces, deposits, joints, and meter diaphragms. Localized fogging during conversion made possible the continuation of fogging in areas cut off from the main station foggers, adding oil to deposits when needed most to prevent their movement during reversals of gas flow. Fogging will definitely continue at Brooklyn Union.

Front view (right) and rear view (left) of one of the four oil foggers installed by Brooklyn Union at main distribution points. This fogger has a capacity of 10 gals. per hour.





When Will We Need Substitute Gas And How Will We Get It?



By CHARLES de MEY • Columbia Gas System Service Corp.

TO those of us who have been a part of the natural gas industry over a period of 20 years or more, the developing and nurturing of our gas supply is probably the most important single activity among all of the various problems of running a natural gas public utility. One only has to go back into the '20s to confirm this feeling because he will find literally hundreds of natural gas companies that fell by the wayside because of lack of natuural gas. So today, when we are beginning to think of supplementing our natural gas supply, very little that is new has been added to the picture and, as I look upon it, we are merely fulfilling our obligation to our customers by assuring them of a continued adequate supply of gas of the kind and quality that can be utilized efficiently in their existing gas consuming equipment.

With this in mind some of our industry members have undertaken preliminary reviews of the situation. In my company we have taken a look at the problem of producing natural gas substitutes from coal by various methods.

We have a fairly comprehensive picture of the gas supply situation and it looks very good. However, we believe that the continued study of developments in the fields of coal gasification and gas synthesis should be a regular part of our studies.

The need for further research to settle the many questions now without adequate answers is evident. The gas industry is equipped for and can afford to undertake such research and it would seem to be good sense for projects relating to coal gasification and the synthesis of a substitute natural gas to be undertaken in the future on a larger scale.

Before going further, it may be well to clarify the term "substitute gas." There seems to be some understandable confusion, since for many years various gases have been manufactured and used in small quantities for peak shaving or standby service. The "substitute gas" that will be discussed here is not for peak shaving or other short term use but is for the supplementing or even complete replacement of natural gas on a permanent basis, if conditions so require. The necessary per unit of capacity precludes operations at low load factors; thus the substitute gas supply is somewhat comparable in its economies to present long transmission line operation.

When I came into the business in 1929, the industry had just gone through a period of diminishing known reserves of natural gas. This had so stimulated company managements that in certain cases long term contracts had been undertaken with producers of coke oven gas in order to safeguard what was believed to be a rapidly diminishing supply of natural gas.

Since that time we have seen the proved reserves vary from 20 to 30 times annual production with the latest calculation of this kind showing a ratio of proved reserves to annual production of slightly more than 24. During this same period the marketed production of natural gas in the United States had increased more than four times but despite this rapid increase the proved reserves have also gained and have kept pace with the ratios that I have just quoted. During 1951, when nearly 8,000,000 MMcf of natural gas were produced, the proved reserves were correspondingly increased by over 8,000,000 MMcf. It is quite evident therefore that that from the historical evidence available we cannot at this time reach any conclusions as to the approximate date when natural gas will be depleted to the point that substitutes will be required in significantly large volumes. The record of the last 25 years shows that our industry has maintained a proved reserve backlog consistent with its market requirements. Even if we could accurately estimate our country's needs for natural gas during the next 25 or 30 years we are not, at the present time, able to forecast with any degree of certainty when substitution of a synthetic natural gas will become necessary. Our natural gas supplies appear to be adequate and we have no positive evidence as yet of a definite remaining life.

I would like at this point to introduce into the picture a variable that perhaps has not been considered in the past to the extent it deserves when predicting future market requirements. I refer to the cost of service or rates charged to the ultimate customer. As we all know, present inflationary trends have not yet been fully reflected in the natural gas rates paid by our customers. It is therefore to be expected that as these rates are increased, as they inevitably must be, the huge demands for natural gas that have been predicted may not fully materialize. Although actual requirements may be in excess of the estimates that have been made by companies changing over from manufactured to natural gas, it would appear that some of the optimistic estimates of the last few years may require revision downward. Those of us who have lived with the house heating and industrial situation through

This paper was presented at the AGA convention in Atlantic City, Oct. 27-30.

the '30s realize how sensitive these markets can be as rates approach competitive fuel costs. Therefore, our continued efforts to bring the presently inadequate domestic and industrial rates up to a level approximating a more rational relationship with other fuels may result in lower ultimate market saturations than some of us have been anticipating during the past few years.

While such a leveling off of consumption will put off the need for substitution, it will also, in my judgment, have other effects that, on the whole, will have a stabilizing influence on our industry.

The natural gas industry must continue to seek new reserves and encourage conservation. We must look ahead as far as possible in undertaking gas purchase contracts and developing storage and production areas on a long range basis. When it comes, however, to estimating the date when the supplementing of our natural gas supplies will commence, in view of the number of imponderables that would require evaluation, I do not think that we can anticipate by much more than five years the need for, or the economic feasibility of, supplementing existing supplies of natural gas with a substitute product.

In other words, some sectors of our business such as individual contracts or production areas can be planned on a fairly long term basis, but it seems impossible to look into the distant future and make reasonably close predictions as to over-all gas requirements and supply. There are too many variables that must be considered and that are not under the control of our industry.

Within the past 30 years, the development of welding and other transmission techniques has spurted to keep pace with the growing demand for gas and the discovery of huge new resources in the Southwest. In the same way, when the ratio of proved reserves to annual production begins to decline, the industry will keep pace with the demand for gas by stepping up research and experimentation in the synthetic or substitute gas field. A sound basis for future development is now being laid, but, since there is a relatively small need at present and in the foreseeable future, progress has been slow.

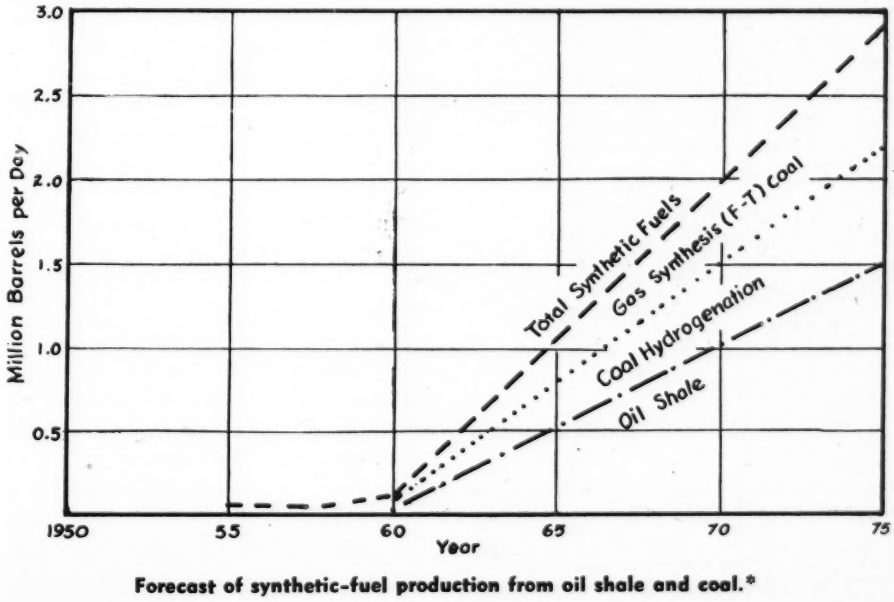
Another indication that the era of substitute natural gas may be approaching will be the increased cost of gas delivered to our distribution systems by the pipeline companies. When a natural gas substitute can compete with straight natural gas, the substitute problem will be solved automatically from an economic standpoint and the reserve ratio will become somewhat academic.

When such indicators appear to us, I believe it will be possible to anticipate the need or desirability of producing large volumes of a substitute gas at least five years prior to the actual need of the gas by our customers. Judging by present developments, I believe that the smallest plant that would be economically practical would have an output of some 100 billion Btu per day. It would probably take almost five years to design such a plant and get it on stream, even if we will have decided on its type and location. Because of this time lag in planning, erecting, and putting into operation a plant for making substitute gas, it seems advisable that we be as nearly ready as possible to proceed when the evidence is at hand that such action is required.

As I have mentioned briefly already, at the present time there are a number of ways and means of producing substitute gas. We cannot say today which of the various processes will eventually prove best—that is why research is needed. Some engineers believe that gas made from oil will come into the picture at one place or another according to the price of suitable oil and proximity to the source of supply of such oil. Eventually coal must be the major raw material, hence it is natural to consider the various procedures suggested for (a) making water gas (mixtures of hydrogen and carbon monoxide) from solid fuels of low cost, and (b) converting the water gas to a rich gas by contacting it with a suitable catalyst at elevated temperatures and pressures. A number of different methods for generating the water gas are now under investigation, and likewise various means for contacting the water gas with catalysts have been studied. Out of all of these research efforts should come a better understanding that will permit one to choose with clearer vision the best process steps to be employed in a plant to be located in a particular environment. Although much of the published data on catalysts indicates that efforts have been concentrated on the production of liquid products rather than gas, information is available pointing the way to reaction conditions that favor gas production instead of liquid hydrocarbons. Further studies along this line should be made.

Before starting the construction of a plant for making substitute gas, a careful study of the plant location must be undertaken for a number of important reasons. The plant will eventually require large quantities of coal and water, hence nearness to a goodly supply of these materials is a practical necessity. Furthermore, the proximity of such a plant to a large pipeline network that can absorb the plant's output at a relatively uniform rate is a very important consideration.

It might be well to take you through the steps as I visualize them at present leading to the assembly of a 100 billion Btu plant for making substitute gas and the steps of producing such gas. Let us start by assuming that we have established the plant on a site that will be within easy transportation distance of the coal supply and located on a river. The plant will require somewhat more than 6500 tons of coal per day and this calls for the necessary coal storage and handling equipment. It is to be noted



Forecast of synthetic-fuel production from oil shale and coal.*

also that the water requirements are some 15 million gallons daily. The output or generating capacity for the mixture of carbon monoxide and hydrogen is approximately 400 MMcf per day. An oxygen generating unit is a necessary part of the plant; this is something relatively new in the production of gas in this country, although it has been found most useful in the gasification of certain non-coking coals in Europe. If the efforts now being made culminate in the development of a process adapted to gasify economically any kind of coal in a granular to a powdered state in a stream of oxygen and steam, an oxygen generating unit having a daily capacity of 90 to 95 MMcf will be required.

Besides the multiple gas generating units there will be the necessary cooling, scrubbing, pumping and purifying equipment and a plurality of reaction vessels confining the synthesis catalyst through which the purified carbon monoxide and hydrogen gas is passed to promote the synthesis of methane and other light hydrocarbons.

First the coal is prepared and sized in accordance with the selected gas making process; it may be very finely powdered as required in powdered fuel gasification processes; it may be coarsely granular as used in still another known process, or it may be sized ⅛ to ½ in., free of dust, and gasified in this state. At any rate, the gas produced from the prepared coal, referred to as synthesis gas, is composed essentially of carbon monoxide and hydrogen with more or less carbon dioxide. This gas is freed from most of the carbon dioxide by washing it with water while it is under suitable pressure, and it is freed of sulfur compounds by passing it through a purification system; the latter step may be of very great importance according to the type of synthesis adapted, the nature of the catalyst adapted, the nature of the catalyst employed in the synthesis steps, and the initial sulfur content of the raw synthesis gas. In the event that the synthesis gas does not contain hydrogen and carbon monoxide in the ratio favorable for the synthesis of the substitute gas, the ratio is changed by treating it with steam at elevated temperatures in contact with an iron catalyst.

The produced and purified synthesis gas is then passed at high pressure through the reactors at controlled rates, contacting the catalyst for an appropriate period of time at a temperature of about 700° F. The hydrogen and carbon monoxide initially present in the purified gas react with one another under these conditions by virtue of contact with the selected iron catalyst forming chiefly hydrocarbon gases with some carbon dioxide and water vapor. The gas leaving the reactors is cooled and scrubbed to remove moisture, readily condensable hydrocarbons, and carbon dioxide. The cleaned and dehydrated gas that leaves the scrubbers is the finished substitute gas.

One can predict practical operation with the production of gas having a calorific value of 800 to 1000 Btu, but, of course, as the heating value is raised from 800 to 1000 Btu, the cost per Mcf as well as the cost per therm increases. The choice of heating value, therefore, will probably be deferred until a later date when the economics of operations are more accurately defined.

The next question is the cost of the substitute gas.

As you have probably already guessed, the unit capacity cost of a production unit will be relatively great. Hence, its operations will normally be as uniform as conditions permit. This means that during the summer its product must be delivered either to underground storage or to seasonal markets that will purchase the output at reasonable rates, or lacking either of these facilities, the plant would supply as much of the base load requirements of existing markets as conditions might permit.

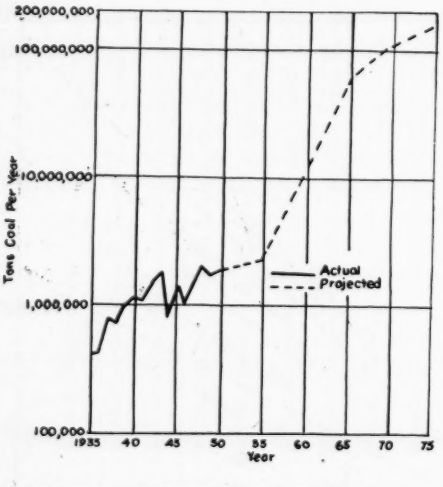
It is seen therefore that the location of the plant will be affected by a number of factors that influence its operating costs and output schedules. Furthermore we are not now able to decide upon the exact type of plant that will be built. For these reasons, current estimates of the cost of substitute gas have varied widely, even though in all cases 95%-100% load factors have been assumed.

If coal were delivered at the plant at $4 per ton, the cost of substitute gas delivered to the pipeline has been variously estimated at between 55 cents and 65 cents per Mcf. The cost of process fuels included is between 27 cents and 32 cents, or some 50% of the total. For each $1 change in the cost of coal, the cost of gas will change about 6 cents per Mcf. Thus if coal is $6 per ton the above costs would be about 67 cents to 77 cents per Mcf.

While these costs seem high at the present time and compare to perhaps a 40-cent to 45-cent cost for southwestern natural gas delivered to the Pittsburgh area, we should not overlook the fact that we are only at the beginning of a large scale coal gasification research and development program and there is every reason to anticipate a relative reduction in substitute gas costs. Conversely natural gas rates appear to be increasing as a result of inflationary pressures that are long overdue.

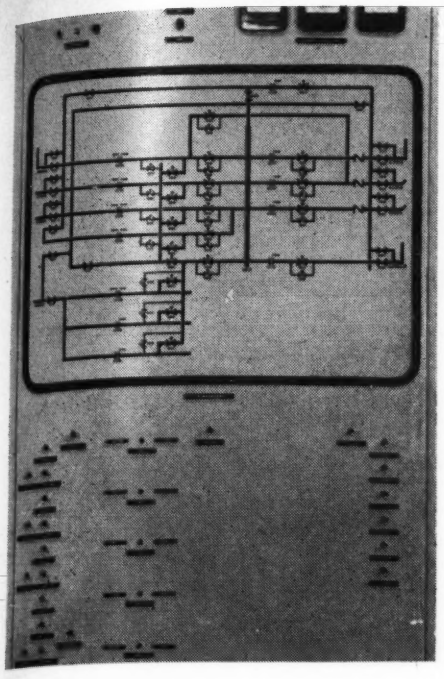
I would like to mention briefly the recently publicized coal hydrogenation operations by the Bureau of Mines and the Union Carbide Co. So far this process has no place in the search for a substitute gas. The hydrogenation process is much more costly per unit of product than gasification, and, while it produces hydrocarbons, they belong to a different group of hydrocarbons, not particularly suited for producing gas but very valuable in the chemical industry.

In conclusion may I offer a suggestion for the future of our industry. I would urge that all gas companies, whether natural or manufactured, give thought to this subject. The industry is now highly integrated and will no doubt become more so. Hence few individual companies can long remain detached from this basic problem. Curtailments and restrictions are *not* a substitute for a supply of gas. We should look forward to adequately supplying our markets. To ignore this responsibility is to court serious economic losses to our industry. Continued research and study of the supply problem are essential and should be a permanent part of our PAR activities since, when the need for a substitute natural gas arises, we should be prepared to start substitution with as little change in gas characteristics and operating economics as possible. Unless such adequate preparations are made, our industry may once again be subjected to the strains of gas shortages with consequent danger of market loss to competitive services.



Total coal requirements for synthetic gas for chemical manufacture.*

*From the President's Materials Policy Commission report.

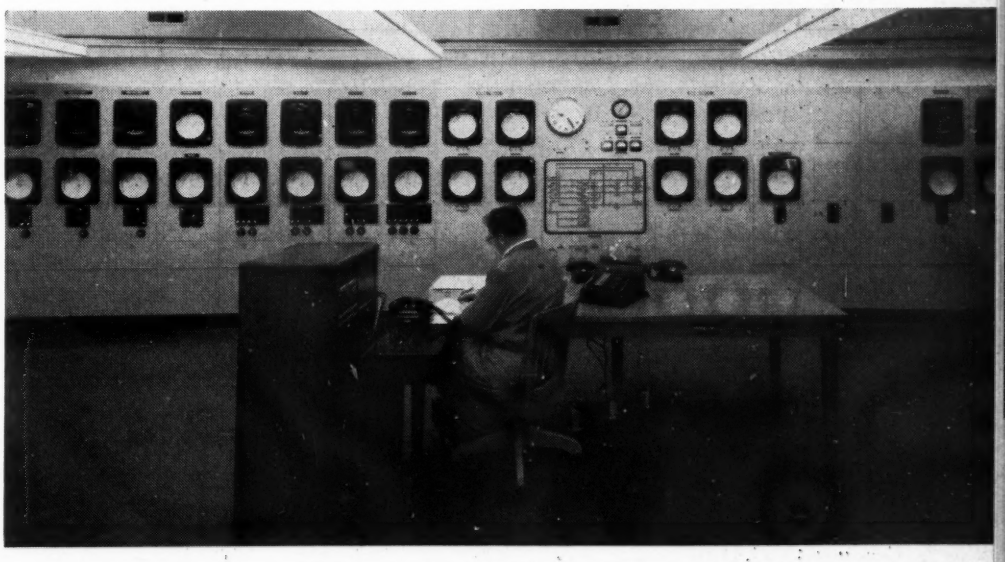


Semi-grahic panel in the Milpitas control room indicates flow through the station. By glancing at signal lights on the graphic section, the operator knows what valves, instruments and lines are in use at any time. Electrically operated plug valves are controlled from switches located beneath the flow recorders.

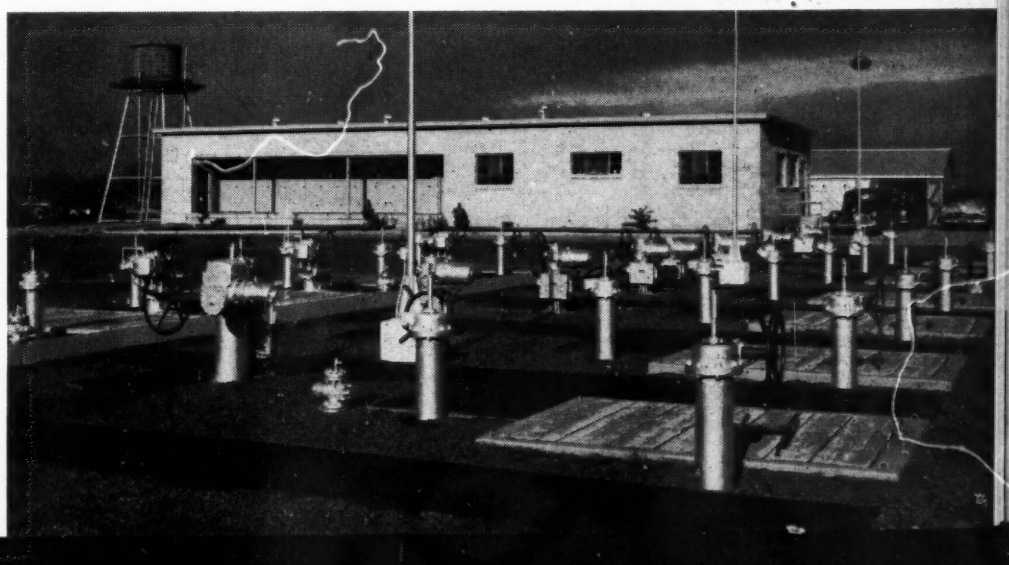
PG&E's Milpitas Station Is System's Nerve Center

THE engineering climax of the vast Pacific Gas & Electric Co. pipeline and distribution system is Milpitas station, distribution center at the San Francisco end of the pipeline network. Here, PG&E engineers have constructed a dispatching station that places control of every distribution function within easy reach of the station operator.

At Milpitas, natural gas from California's Kettleman Hills and Rio Vista fields is received, adding this local supply to the tremendous quantities from Texas and New Mexico, delivered to PG&E at Topock on the California-Arizona border by the El Paso Natural Gas Co. From Topock, the 502-mile "Super Inch" line bridges the Colorado river, spans the Mojave desert and scales the Tehachapi mountain range to reach more than one million users served through the Milpitas terminal.



Foxboro instruments keep a 24-hr watch over pipeline pressures, temperatures and flow. Thirty-two instruments are mounted on the panel board, which occupies an entire side of the control room. In addition to the consistent, accurate data on measurement and control furnished by the instruments, the operator obtains additional information by telephone on gas flow and pressures from distant parts of the system. Doors near the bottom of the panel sections are easily opened, exposing flow meter manifold to facilitate reversal and routine calibration of the instruments mounted above. Meter reversal provision permits emergency feedback of gas in the event of supply interruption.



Milpitas terminal, nerve center of PG &E's Bay area gas system. Underground valves in concrete pits are operated remotely by instruments within the control building. At the left of the building, protected by an overhanging roof, are steel doors that provide ready access to the back of the panel for instrument service. Tight closures ensure adequate protection from the weather.

Two types of residential sections in the Contra Costa region of California were covered in this study. One was made up of 47 large homes and the other of 259 small tract homes.

A Preliminary

DESIGN LOAD STUDY

For a Distribution System

By ALDEN BRYANT
Coast Counties Gas & Electric Co.
San Francisco

THE rapid increase in gas customers in California is no longer news, but the long-run problem of designing for future load is still of primary importance. There is a constant stimulus to know the distribution system better and to find new techniques for forecasting load, both year by year and for an entire design period.

Master planning has taken on new importance during the last decade. W. C. Mosteller[6] presented a very helpful account of his handling of distribution design to the Pacific Coast Gas Assn. in 1945. In the same year, K. B. Anderson outlined the approach to the problem by Coast Counties Gas & Electric Co.

Each winter a multitude of decisions must be made as to load to be supplied to particular communities and consequent pressure settings. In the city of Concord, for example, the pressure can be set early in the winter to take care of the city according to past records and experience. What adjustment in pressure settings should be made, however, for a large new subdivision that did not require gas the previous winter, especially if that new subdivision is outside of the city and relatively far from the point of regulation? A rough load estimate can be made and a large safety factor thrown in, or some more precise technique can be used.

Pressure setting is basically determined by the peak load that must be supplied the new subdivision. In a master plan for a distribution system it is necessary to (1) estimate the peak load requirements of each community, then (2) see if the combined load required by several communities can be supplied by the feeder line or lines supplying that area, and (3) determine if there is sufficient supply (and pressure) in the transmission lines bringing gas to the distribution system under investigation.

It was in the context of master planning and yearly pressure control that our design load study was prepared. A two and one-half months' study was made of two housing areas in our Contra Costa region to determine actual load and load response to varying weather conditions.

Specific information was sought on (a) customer usage, (b) load per acre, (c) physical characteristics of houses in the test areas, and (d) the relative effect of temperature, wind velocity and sky radiation on load.

This study is a preliminary one. The results and a brief analysis of them are presented below in order to allow an evaluation of this project and to pave the way for further and improved sample load studies.

The Institute of Engineering Research of the University of California provided assistance in several ways. The institute is an organization of university personnel which will conduct an entire research project for an outside company or will rent instruments so that a company may conduct its own research. In this case, the institute rented temperature, relative humidity, wind and sky radiation recording instruments to our company. J. T. Gier and R. V. Dunkle assisted in the plans for the test and the final analysis of data.

Table 1. Analysis of Customer Sampling in Test Areas Based on 16 Customers in Each Area

	Glen[1]		Granada	
	Range	Average	Range	Average
Connected load, cf/hr	126- 206	163[2]	102- 152	121[3]
Connected heating load, cf/hr	100- 168	123	40- 60	49
Floor space, ft²	1280-2400	1715	850-1200	1035
Window space, ft²	218- 508	312	140- 217	183
Percent use of connected load, Dec. 1951 through March 1952	22- 39	27	12- 21	16
Percent use, maximum instantaneous peak for test area		74.5 (3/5/52)		32 (1/9/52)
Connected furnace load Total connected load, %		72.05		39
Peak load Connected furnace load, %		94		84.5

[1] Average monthly consumption per customer is 8.5% higher for the 16 customers in the sample than for the 47 customers in the test area.
[2] Only two out of 16 sampled customers had gas ranges.
[3] All sampled customers had gas ranges.

Plan of the Test

In order to carry out the objectives of the study, sample areas had to be chosen throughout the company's Contra Costa

This paper was presented before the PCGA technical section distribution conference in Los Angeles, April 16-17.

region which would meet proper criteria and thereby lend themselves to obtaining the detailed information desired. Criteria entering into the choice of test area are as follows:

1. Number of customers.
2. Homogeneity of customers (similar load requirements).
3. Size of houses and lots.
4. Ease of segregating test area distribution system.
5. Suitability of instrument site.
6. Geographic location such that the instrument site could be assumed to give readings of meteorological variables that would hold for the entire test area, e.g., same temperature and wind velocity.

Homogeneity of houses in a sample is considered desirable. The method implicit in this project is to develop load data for each of several categories of housing. Subsequent load forecasting will then be based on estimates of how much housing of each category will be built in the forecast area. Likewise an estimate of a present actual load will be based on an estimate of the amount of each type of housing that there is of each category.

Actual floor and window space, lot size, connected load and gas metered to each customer for a given period can be determined for any customer sample that is selected. In this particular study, the two test areas were:

(A) *Glen Road and Monticello Road, Lafayette.* The 47 houses are all relatively large and fairly homogeneous. They are one story, modern with large windows, are one to five years old, and have large lots. A property owner agreed to allow the test station to be placed on the edge of his undeveloped lot for the duration of the test period, and at the end of that period the instruments and the orifice meter were to be removed.

(B) *Granada Drive, Monte Gardens Subdivision,* Units 1 to 6, Concord. There are 295 customers in the area. The one-story, tract houses are all less than five years old, and are quite uniform in size, window space, connected load, and lot size. Monte Gardens is located on the edge of the Concord area on level, open country. *Fig. 1* shows the location of the test station inside a fence, on the corner of a lot where commercial buildings will be built soon to serve the subdivision.

Table 1 gives a comparison of the physical characteristics of the homes in the two test areas based upon 16-customer samples taken within the test areas.

It is contemplated that at least four types of samples should be studied, two of which are covered in this paper. The remaining two types of samples could be: (1) a city's oldest and smallest houses, with small lots, and (2) the largest houses in the region. Homes in the largest category are scattered throughout the region with no single

TABLE 2. Measurement Technique Employed and Instruments Utilized for the Variables of Gas Load, Temperature, Wind Velocity, Sky Radiation, and Relative Humidity

Measurement	Instrument
Gas load	
Continuous record of gas metered to test area, showing instantaneous peak load for each day. Twenty-four hour charts used.	Two-inch orifice meter
Temperature	
Continuous record of temperature taken at each test station. Twenty-four hour charts used.	Hygro-thermograph, clock driven
Daily check made on recording instrument.	Maximum-minimum thermometer
Wind velocity	
Continuous record of wind velocity taken at each test station. Twenty-four hour charts used.	Three-cup anemometer Anemometer recorder, battery operated
Wind direction entered in field book each time charts were changed.	Wind vane (non-recording)
Sky radiation	
Continuous record of sky radiation taken at single test station located midway between the Glen and Granada test stations. Roll charts used—approximately two weeks per roll.	Flat plate radiometer used as total hemispherical radiometer Potentiometer recorder
A continuous record was also kept of the short wave length, or solar, radiation. Actual sky radiation at the two test stations was checked against the continuous recording. Portable unit operated from a car battery.	Pyrheliometer, connected to Potentiometer recorder Portable potentiometer AC-DC converter
Relative humidity	
Continuous record of relative humidity taken at each test station. Twenty-four hour charts used.	Hygro-thermograph
Daily check made on recording instrument. Temperature and relative humidity taken under standard conditions. Anemometer recorder included in same housing.	Sling psychrometer U. S. Weather Bureau instrument shelter

Fig. 1. The Granada drive test station at left showing the orifice meter, instrument shelter, and tower with three-cup anemometer and wind vane. At right is the instrument shelter interior. The upper pen arm on the hygro-thermograph shows the temperature; the lower arm indicates relative humidity. Also shown is the recording anemometer.

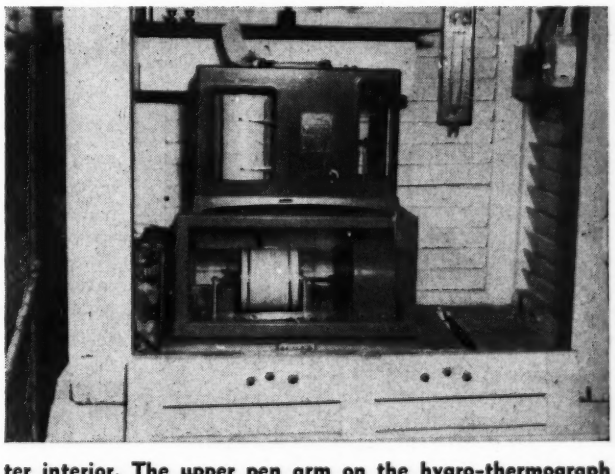


TABLE 3. Monte Gardens Granada Test Area

Peak Load Per Customer

Month	Range cf/hr/c	Number of Days of Data	Average cf/hr/c
January 4-31	26-40	25	33
February	25-39	29	31
March	16-40	30	30

Peak Load Per Customer Frequency Distribution By Days

Load cf/hr/c	January 4-31	February	March
15-19			4
20-24			2
25-29	3	11	4
30-34	11	13	10
35-39	10	5	9
40-44	1		1
Number of days of data	25	29	30

group of such houses being conveniently situated so as to allow system segregation and a load study. On the other hand, it may be that a sample of semi-rural houses, with acres of fruit or walnut trees, should be included in an overall load study perspective for this region.

Instrumentation

The instruments used were primarily those available for rental through the Institute of Engineering Research. The measurement technique employed and the instruments utilized are listed in *Table 2* for the variables of gas load, temperature, wind velocity, sky radiation and relative humidity.

Instrumentation problems are inseparable from problems of collecting data. The collection of data was an operational problem and followed the general lines of field organization. The gas department was authorized to conduct the study. The engineering staff participated in planning the project, the district foremen in the two districts concerned were assigned responsibility for operating the test stations, and the servicemen in the districts changed the charts under the supervision of their respective foremen, and adjusted the instruments as necessary. A specialist from the University of California was needed only once to repair one of the instruments.

A field book was kept for each test station with daily entries made on:

1. Relative humidity as read by a sling psychrometer.
2. Chart reading of relative humidity.
3. Chart temperature reading.
4. Temperature readings from the maximum-minimum thermometer.
5. All adjustments made on the instruments.
6. Percent cloud coverage.
7. Wind direction.
8. Any special problems in the operation of the instruments.

The instruments served their functions with varying degrees of adequacy. (1) The orifice meters were used primarily to obtain instantaneous peak gas load, and secondarily to obtain customer use per day and per month. (2) The hygro-thermograph gave a good temperature record, requiring few adjustments or corrections in the data, and those only in the order of one degree. (3) The relative humidity record proved to be the most unreliable part of the data obtained. The relative humidity pen arm is activated, via the proper leverage, from a series of human hairs which contract or increase in length according to the relative amount of moisture in the air. The readings obtained with the two instruments in question were usually much above the relative humidity as checked by a sling psychrometer. In fact on many mornings, at the time of the peak load, there was little correlation between the hygro-thermograph reading and the actual relative humidity. Moisture may have collected on the hairs during the night causing the instrument to read 100% well into the morning when it should have been reading substantially less than 100% and dropping rapidly. (4) The anemometer recorder marked off on a time scale the passing of each knot of wind. so that an average wind velocity in miles per hour could be calculated from the charts.

Customer Usage

Tables 3 and 4 give a breakdown of peak load per customer obtained by dividing the instantaneous maximum input to the test area by the number of customers in the area. Meter records were used to establish the actual number of customers in the area for each day of the test period. The results were slightly lower than expected for the Monte Gardens homes (40 cf/hr/customer, max.), and slightly higher for the Glen road homes (111 cf/hr/customer, max.). The range and frequency distribution of the peak values are presented to illustrate customer response to environmental conditions in the test area, and thereby in all areas with similar housing and weather.

TABLE 4. Glen Road Test Area

Peak Load Per Customer

Month	Range cf/hr/c	Number of Days of Data	Average cf/hr/c
January 19-31	68-100	13	85
February	65-105	29	89
March	34-111	31	82

Peak Load Per Customer Frequency Distribution By Days

Load cf/hr/c	January 19-31	February	March
30- 39			1
40- 49			1
50- 59			4
60- 69	1	1	
70- 79	2	5	3
80- 89	6	6	7
90- 99	3	12	14
100-109	1	5	
110-119			1
Number of days of data	13	29	31

Table 5 gives a breakdown of daily use per customer obtained by dividing the daily input to the test area by the number of customers. Average day use per customer figures are presented for week days and weekend days separately. *Table 6* provides a picture of the frequency of occurrences of peak loads of different magnitudes, during the test period.

Inspection of the sample data as a whole showed that there is little justification for discarding the weekend data. Throughout this study weekend data have been included with the week day data. It is true that the peak load is nearly always later in the morning on weekend days and holidays than during the week, but a plot load vs. temperature is concerned with these two variables only, not with the time of the peak per se. In this particular sample (of approximately 65 days of data) the peak loads corresponding to the later weekend peak-time temperatures provide points that fall well within the deviation of the other points. In fact the results of this study would decrease considerably in their reliability should the weekend data be discarded. Such discard would actually introduce an unnecessary bias into the results as well as provide a smaller body of sample data.

Temperature, or peak temperature, unless otherwise stated, represents an average temperature during the 30 minutes prior to the time of the corresponding peak load.

Table 7 shows the monthly use per customer obtained by dividing the total month input to the test area by the average number of customers in the area for the given month. It is interesting to note the Glen monthly and maximum daily figures are about twice the Granada figures, whereas the maximum instantaneous peak load figure is about three times as large.

Sampling of Test Areas

A sample of 16 houses was taken in

each test area to determine connected load, floor space and window space. (See *Table 1*). The sampling was supposed to be random in each case, i.e., without bias so that the sample houses would have the maximum probability of representing the test area as a whole. In Monte Gardens every 20th house was chosen. In the Glen road area it was desirable to sample every third house, but practical considerations such as time and availability of customers limited the randomness of the selection. A comparison was made between the sample customers and the customers in the test areas for average monthly consumption per customer. The Glen road sample figure was 8.5% higher than that for the test area; and at Monte Gardens, the sample figure was about 2% lower than that for the test area. It is quite possible that the better representation of the Monte Gardens sample is due to more random selection.

A correlation was attempted between load on one hand and the three variables of connected load, floor space and window space on the other. Plotting peak load against each of the three variables shows a very general trend, but there is a negligible degree of correlation. An attempt was made to develop a four-variable equation making load a function of the other three variables taken together. For each such equation developed the dispersion of derived points around actual points was so great as to result again in relatively little correlation. It is suggested that individual customer behavior patterns are responsible for more variation in individual gas consumption than physical factors of connected load, floor space or window space (within the test area).

Two sets of data are given in *Table 1* for percent usage. The first percent use data, i.e., percent of connected load, represents individual customer usage for four months (December 1951 through March 1952); the range of customer usage and an average value are given. The second set of percent use data has to do with the maximum instantaneous peak for the test areas.

Table 1 shows that the heating load is 72.5% of the total connected load for Glen road and only 39% for Monte Gardens. The percent use at the time of peak load is of the same order of magnitude, i.e., 74.5% and 32% respectively. It is suggested, therefore, that (actual peak load)/(connected heating load) is the best ratio of those presented here to use in design work. In this case the ratios are 94% for Glen road and 84.5% for Monte Gardens. Some furnaces may not be on at the time of peak load and many ranges and water heaters may be on. The ratio recommended above, however, is the best one to use for design load estimates given the sample data utilized in this study.

Gas Load Per Acre

Water utilities have worked with water per acre data for many years (acre-feet). Gas industry personnel on the other hand have given some attention to gas load per acre but have not yet incorporated "per acre" data in their forecasting procedures. Computations of load per acre were made for the test areas in this study and are included in *Table 8*. *Table 9* indicates the variation in lot size within the Glen road test area. The smaller, more closely grouped houses need a greater load supplied them than do the larger houses. The load per acre ratio of Granada:Glen is approximately 1.32 for the test period (see *Table 10*). No statement can be made on the basis of the data obtained as to a possible seasonal change in this ratio.

TABLE 7. Average Monthly Consumption Per Customer by Months

(Mcf Month)

	Glen	Granada
February	23.6	12.7
March	25.7	13.0

The load per acre theory may prove a definite aid to master planning at sometime in the future. There are several existing conditions which already point in this direction. Large scale zoning is a fairly reliable indication of the size lots an area will have in the future and the size houses on the average. If the size houses which will be built in an area in the future is unknown, it becomes necessary to design for the smallest lots and the highest gas load, which load can be determined by sample study of existing housing. The Monte Gardens peak load per acre of 178 cf/hr/acre, plus an added increment to allow for a "design low" temperature, could be referred to as the (Contra Costa region) *subdivision rate.*

Load Determinants

Given a number of houses of a certain size, in a sample large enough to eliminate any significant effect from differences in customer behavior patterns, then the determinants of load are for practical purposes confined to meteorological conditions.

These conditions can be measured and the results arranged graphically so that one can tell by inspection what the peak load will be in an area about which he is concerned. Control charts, which pro-

TABLE 5. Daily Use Per Customer cf/day/c

Glen Road Test Area

Month	Range	Average Week Days	Average Week-end Days	Average Total[1]
January 20-31	556-1160	900	840	884
February	409-1200	831	770	850
March	170-1218	828	851	810
Monte Gardens Subdivision				
January 4-31	396-607	542	483	499
February	318-566	440	435	437
March	149-590	414	430	418

[1] Average for total days in the month $= \left(\frac{N_d}{Sq} \div N_c\right)$

Where Sq = sum of Mcf/day values
N_d = number of days
N_c = number of customers

TABLE 6. Average Daily Use Per Customer Frequency Distribution by Days (cf/day/c)

	January 20-31		February		March	
	Glen	Granada	Glen	Granada	Glen	Granada
100- 199					2	4
200- 299					2	3
300- 399		1		8		2
400- 499		10	1	15	1	13
500- 599	1	12	3	6	2	8
600- 699		2	4		2	
700- 799	2		8			
800- 899	3		5		5	
900- 999	3		2		5	
1000-1099	2		3		8	
1100-1199	1		2		3	
1200-1299			1		1	
Number of days of data	12	25	29	29	31	30

TABLE 8. Peak Gas Load Per Acre[1]

Month	Peak Load Date	Peak Load Mcf/hr	Peak Acre Load cf/hr/acre
Granada			
January 4-31	9	11.8	178
February	21	11.0	165
March	15	11.7	176
Average lot = 0.22 acres			
Total area = 66.5 acres			
Glen			
January 19-31	29	4.3	115
February	13	4.6	124
March	5	5.1	134
Average lot = 0.71 acres			
Total area = 38 acres			

Ratio: Granada / Glen	February	March
	1.33	1.31

[1]Acreage of test areas includes roads adjacent to customers.

vide a part of such information, are presented in *Figs. 2* and *3*.

An average temperature for the 30 minutes prior to the instantaneous peak load has been used in this study.

Since mean temperature is used widely in the gas industry for forecasting peak loads in distribution systems as well as in transmission lines, a relationship between mean temperature and peak-load temperature is provided in *Fig. 4* and in *Table 11*. There is good correlation between the two temperatures. The limit lines shown on *Fig. 4* mean that there is a probability of one chance in a hundred that a point (representing a mean temperature and the peak-load temperature of the same day) would lie outside these 1% limits.[10] If in a distribution system area, similar to the Glen road area, the mean temperature were 50° F, then the most probable value of the peak load temperature would be 42.5° F. There would be one chance in a hundred that the peak load temperature would be as low as 39.5° F.

Peak load-temperature data are often plotted in a straight line relationship for purposes of estimating peak load for a design minimum temperature. The linear relationship is then assumed to hold over the range of temperature in question. This is not always done, however. D. K. Smith[1] shows a load-temperature curve that is non-linear, tending to flatten off at the ends.

This study, with its assumptions and method of investigation, is a preliminary

TABLE 9. Glen Road Test Area Distribution of Lot Sizes

Size Acres	Customers
0- .49	10
0.50- .99	30
1.00-1.49	4
1.50-1.99	1
2.00-2.49	1
2.50-2.99	1
Total	47

one. It was not felt justified to attempt to develop a non-linear curve for the data shown graphically in *Fig. 5*. This figure represents an approximation utilized to study the test data.

A small-sample check was made by plotting values of load against temperature for three categories of constant wind velocity *(Fig. 5)*. It is possible to derive the algebraic expression for the curves, but the deviation and small number of points for each curve indicate that the sampling error is too large for the results to be useful. This is an illustration of the difficulty in obtaining enough points to develop a reliable sample population. It should be noted that although these were the best possible groups of points that were available for load-temperature curves, at constant velocities, two curves

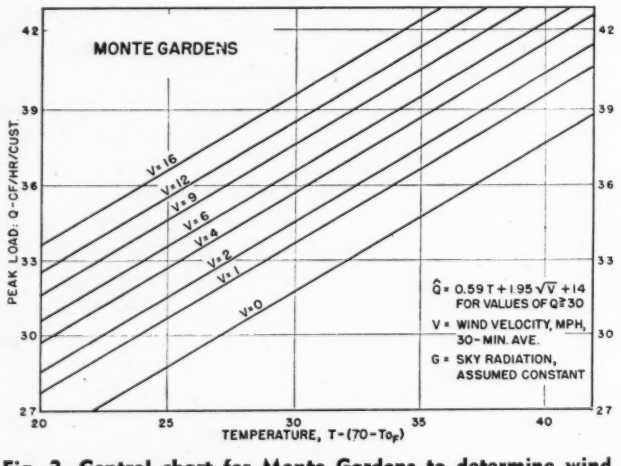


Fig. 2. Control chart for Monte Gardens to determine wind velocity.

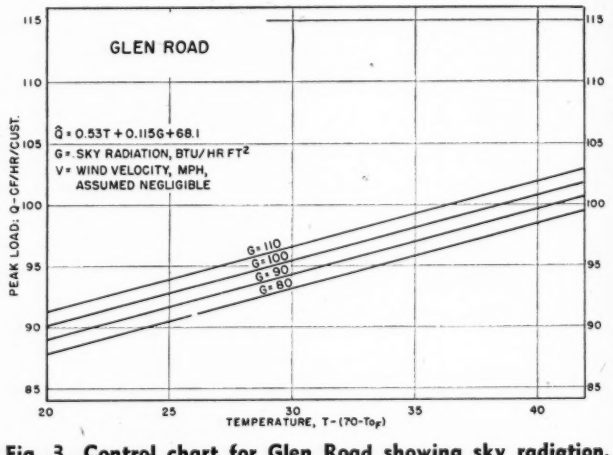


Fig. 3. Control chart for Glen Road showing sky radiation. Both Figs. 2 and 3 are used in determining load.

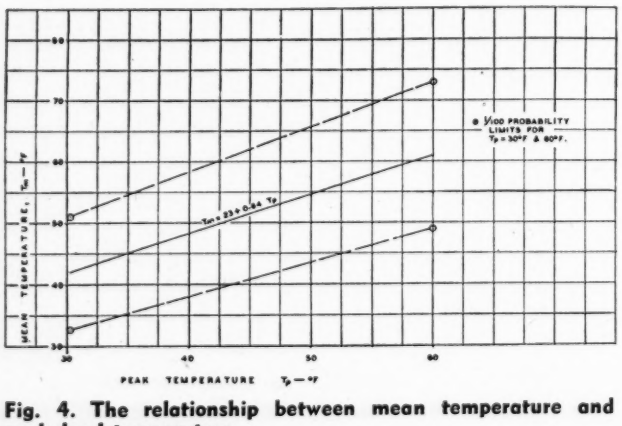


Fig. 4. The relationship between mean temperature and peak-load temperature.

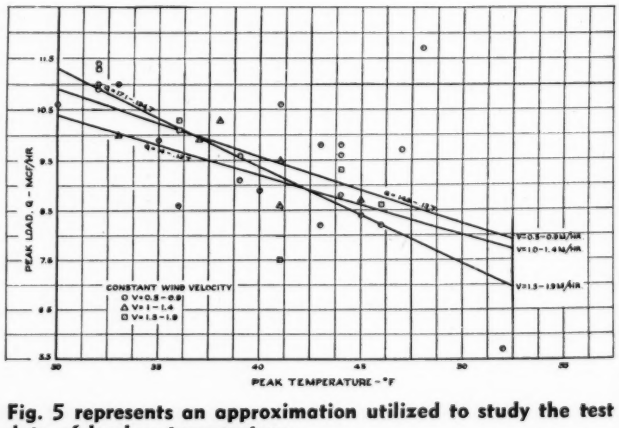


Fig. 5 represents an approximation utilized to study the test data of load vs temperature.

are reversed in position and one crosses the other two. Such deviation in slope and position, on the part of the small-sample curves, is highly probable because of the size of the sample.

The conclusion is apparent that unadjusted data in small samples cannot be used in this case where there are only a total of 65 days of data; large samples and adjusted data provide more satisfactory correlations.

In line with the above conclusion a large sample was used, including all available data. From small samples of 12 or 13 days data, the change was made to a large sample using 65 days of data.

Certain assumptions were made in order to conduct a statistical analysis of the data. These assumptions were made partly on the basis of gas industry experience and partly on the basis of sky radiation tests conducted by the University of California. The assumptions are listed below.

1. Temperature is the most important characteristic of weather. (Weather can be thought of as heat exchange and water exchange plus the movement of air masses integral with these exchanges.)
2. Wind velocity is the second most important characteristic of weather which affects peak gas loads.
3. Sky radiation is the third characteristic of weather determining load, but less in its effect than either of the first two.
4. Relative humidity tends to change inversely with, but in proportion to, sky radiation. As the sun rises the relative humidity falls. Sky radiation effect can be treated, in a preliminary approximation, as combined with relative humidity effect on peak gas load. Hereafter mention will be made only of sky radiation.
5. The wind velocity effect and sky radiation effect on load distribute the values of load around the load-temperature curve in a fairly even pattern. These secondary effects tend to average out for a large sample of 60 days of data. Hence curves representing Q and T only do adequately reflect the load-temperature relationship.
6. The values of load, adjusted for temperature, can be plotted against values of wind velocity. Over a large sample, sky radiation effect averages out, and a load-wind velocity curve can be derived.
7. The values of load can then be adjusted for wind velocity, so that a plot can be made of load-sky radiation, with temperature and wind velocity considered as constant. A curve can be derived for load-sky radiation.
8. The slopes of the three derived curves are ratios showing the effect on load of each of the three variables, treated independently.

Only data from the Granada drive test station in Monte Gardens was given this treatment.

An equation derived for the increase in peak load with drop in temperature had a slope of 0.53 cf/hr/cust. per °F, for the large sample, where the slope represents the rate of change of Q with T.

Calculations have been omitted from this paper in the interest of brevity since each equation represents a lengthy process. The writer will be glad to furnish, upon request, further detail and calculations.

The slope of the small-sample (load-wind velocity) curve was 0.50 cf/hr/cust. per mile/hr. The slope of the large-sample curve was 0.35 cf/hr/cust. per mile/hr.

After the large-sample treatment was applied to the load values from Granada, the load values were adjusted for a second time to back out wind velocity effect. The slope was calculated (Snedecor's[10] linear regression derivation) to be —0.076 cf/hr/cust. per Btu/hr ft².

To illustrate the above, compare two mornings for the large sample, the second of which has a value of T 5° F colder than the first, an increase of V from 0 to 10 mph, and a drop in G from 110 to 80 Btu/hr ft². The increase in load would be 2.65 + 3.5 + 2.28 or 8.4 cf/hr/cust. This is an appreciable increase when the normal maximum winter peak is in the magnitude of approximately 40 cf/hr/cust.

A statistical test of the data (see Snedecor[10], p. 122) shows that in each of the above three large-sample equations the data are from a single homogeneous population of data. Roughly this means that there is a significant degree of correlation for load-temperature, load-wind velocity, and load-sky radiation.

There is a special limitation upon the Monte Gardens large-sample results for load-wind velocity and load-sky radiation, obtained through a multi-step process. The load values were first adjusted to an average temperature of 44° F (Q′) in order to then derive an equation for load vs. wind velocity. Subsequently

TABLE 10. Sample Area Comparison

Glen Road Test Area vs. Monte Gardens Subdivision

	Glen	Granada
Number of days in sample	68	65
Number of customers in test area	47	295
Peak load per customer, cf/hr/customer	34- 111	16- 40
Daily use per customer, cf/day/customer	170-1218	149- 607
Monthly consumption per customer Mcf/mo/cust.		
February	23.6	12.7
March	25.7	13.0
Connected load, cf/hr		
Range	126- 206	105- 152
Average	163	121
Floor space, ft²		
Range	1280-2400	850-1200
Average	1715	1035
Window space, ft²		
Range	218- 508	140- 217
Average	312	183
Percent use (of connected load)		
Four winter months (December 1951 through March 1952)	27	16
At highest instantaneous peak for test area	74	32
Peak load/connected heating load	94	85
Peak gas load per acre		
Average lot size, acres	0.71	0.22
Peak acre load, cf/hr/acre	134	178
Ratio of acre loads	1	1.32
Peak Load Weather Conditions		
Temperature, °F		
Range	29- 55	30- 60
Wind velocity, miles/hr		
Range	0- 9.7	0- 12.7
Sky radiation, Btu/hr ft²		
Range	81- 181	83- 190

TABLE 11. Monte Gardens

Day Mean Temperature vs. Peak Load Temperature[1] Frequency Distribution of Differences[2]

January 24 - March 31, 1952

	Frequency	Percent
(—5) - 0	1	1
0 - 4	17	27
5 - 9	33	51
10 - 14	13	20
15 - 19	1	1
	65	100

[1] Average temperature for 30 minutes prior to peak time.

[2] Difference equals $T_{mean} - T_{peak}$, °F.

Temperature Variation

	Range
Day mean temperature	40.5 - 68
Peak load temperature	30 - 60
Difference	(—4) - 15

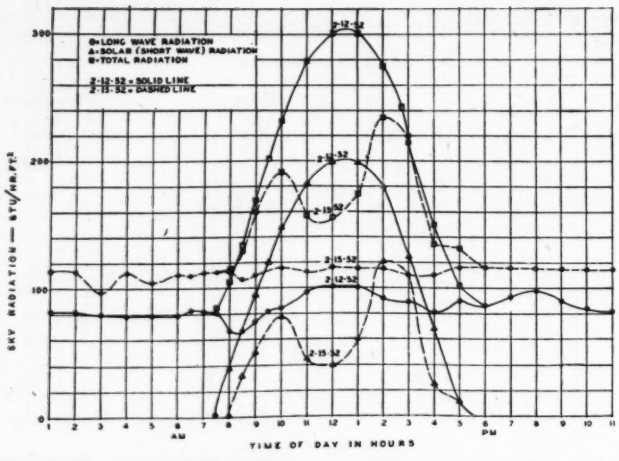


Fig. 6. The sky radiation effect, comparing a cloudy day with a clear, sunny day.

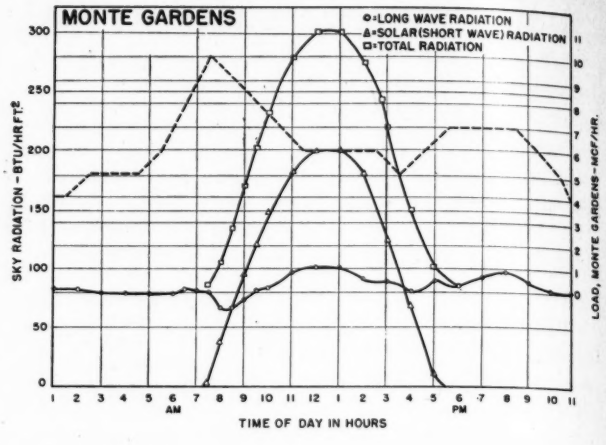


Fig. 7. The load curve for Feb. 12 superimposed on the clear-day curves shown in Fig. 6.

these load values (Q′) were adjusted a second time to an average wind velocity of 2.2 miles-hour (Q″) in order to derive an equation for load vs. sky radiation. Temperature and wind velocity are in this way assumed to be held constant. This also means that the curve for load-sky radiation most closely represents test conditions when T is 44° F and V is 2.2 mph. No claim can be made here as to the form of the load-sky radiation curve at any other temperature, wind velocity base, or any other temperature base. This question of non-linear curves is outside the scope of the present paper, which is concerned with gaining initial operating figures and demonstrating a method.

Sky radiation effect is further illustrated in *Figs. 6* and 7. The total hemispherical radiation is the sum of long wave radiation from the sky and short wave radiation from the sun (see *Table 12*). *Fig. 6* compares a cloudy with a clear, sunny day. The drop in solar radiation on Feb. 15 is shown as clouds cover the sky during the middle of the day.

If a house is at a temperature of about 70° F, the house will irradiate the sky at the rate of 136 Btu/hr ft². In *Fig. 6*, Feb. 12 curve, sky radiation reaches 136 Btu/hr ft² at about 8:30 a.m., and 200 by 9:30 a.m. From 8:30 a.m. on, more radiant energy is passing from the sky to the house than from the house to the sky. It is at this time that the total hemispherical radiation warms the house and tends to induce the home owner to turn off his furnace. It should be pointed out that it is short wave solar radiation that is primarily responsible for reducing gas load in the morning. In brief, if the sun comes up in a clear sky before the peak load is reached that peak will not be as high as it might have been under a dark or cloud-covered sky.

Fig. 7 shows the load curve for Feb. 12 superimposed on the clear-day curves in *Fig. 6*. Each load value is the average for the hour. A more detailed breakdown of the load data is not necessary since the object of *Fig. 7* is not to demonstrate the irregularities in a load curve but to show the relation in time between the peak gas load and increasing solar radiation.

The relation between (1) sky radiation effects on house heating and (2) surrounding air temperature is difficult to distinguish. Temperature, as indicated on a thermometer shielded by a weather shelter, and sky radiation, as indicated by direct-reading instruments, are at the same time integrated and separate factors. The sun's radiation warms the earth, providing the energy for the increase in ground and air temperatures during the day. If the sun comes up early in the morning and strikes a house, the irradiation by the sun of the house will warm the house even though there is no noticeable increase in "temperature" around the house. On the other hand, when the "temperature" is rising, sky radiation, including the sun's short-wave radiation, will still cut down house heat losses faster than if there is a cloudy sky or if it is too early in the morning for the sun's radiation to strike the house.

The Q-T, Q-V and Q-G ratios of —0.53, +0.35 and —0.076, respectively, obtained by the three-step method outlined above, do not necessarily bear out the original assumptions. Changes in T and V have a similar effect on Q, and G has a smaller effect.

Since the assumptions listed previously were utilized in deriving the slope constants, the equations are not necessarily proof of the assumptions. A more comprehensive treatment is necessary.

Snedecor[10] provides a four-variable analysis technique (pp. 342, 360) which can be used to obtain an expression for Q as a function of T, V and G simultaneously. This method was applied to the same Monte Gardens subdivision (Granada station) data as was the three-step method, and also to the Glen road station data.

It is known that house heating involves a "periodic heat flow" problem. House walls are subject to the heating cycle of day and night temperatures, plus house heating by gas or other means.

An eastern house heating study[11] shows a concern with the time lag in house heating. Those conducting the experiment obtained data to show the length of time for changes in external conditions to affect internal temperatures. This problem is more serious in the east where the temperature differentials between room temperature and outside temperature are greater during winter than in California.

An examination was made of the test data obtained at Glen and Granada stations to determine whether load corre-

TABLE 12. Sky Radiation

(Btu/hr ft²)

Month	Range[1] Kv (Solar)	$6\,T_m^4$ (Sky)	G_T
	Glen		
February	(—28) -40	102-121	81-160
March	(—50) -62	100-124	82-181
	Granada		
February	(—27) -25	103-125	83-142
March	(—25) -70	103-124	84-190

[1] $G_T = Kv + 6\,T_m^4$ Btu/hr ft²

Where:

- G_T, Tota' hemispherical radiation or the total irradiaton upon the plane of the meter surface.
- K, Meter constant.
- v, Mi'livolts produced by the thermopile in the meter.
- T_m, Meter temperature, degrees Rankin.
- 6, Stefan - Boltzmann radiation constant = 1.72×10^{-9} Btu/hr ft² (R)⁴.

lated better with weather conditions two hours prior to the peak-load time than with the conditions at the time of the peak. The four-variable method was utilized to obtain equations.

Deviations between actual load Q and estimated load Q′ were calculated and analyzed. In the case of the Granada data, the equation based on peak-time values of T and G gave significantly better results than the comparable equation based on T and G values two hours prior to peak time. (See *Table 13*, equations 1 and 2.)

It is to be noted that temperature in the single-step equations is taken to be 70 minus the actual peak time temperature reading. (See *Table 13*.)

In the case of the Glen data, equations 7 and 8 give practically the same results. The Glen estimated data, however, consistently shows greater deviation from the actual than does the Granada data. In the Glen area there were only 47 houses, as opposed to 295 in the Granada area, and the Glen houses varied more in size. Several families were either away or had ill people in the house and used more than the average amount of gas for heating. Sampling error is definitely larger for the Glen area. Consequently more weight is given to the Granada comparison in which the equation based on all peak-time data gives the better results.

An examination of *Table 12* will show the steps taken to obtain equations useful for the two purposes mentioned previously, i.e., meeting winter peak demands and master planning.

The one-step method treats the four variables interdependently. For Granada data, equations 1 and 3, or 4 and 6, give similar results, with equation 6 being slightly better.

It will be noted that only the slopes, i.e., the T, V and G constants, in equation 3 have been discussed previously. Equation 3 was derived by substituting actual values of Q into the expression $Q = aT + bV + cG + K$ and solving for K; 61.4 is an average of 52 values of K from $Q = 15$ to $Q = 39$; 62.6 is an average of only 33 values of K where Q is equal to or greater than 30 cf/hr/cust.

The equation representing the Glen data, i.e., 9 simplified to 10, is quite satisfactory. Equation 9 was derived from the test data and not from 7, and provides estimated values of Q′ that fall below the actuals by more than 2.5 cf/hr/cust. only one time in 20.

Equation 6 provides approximately the same results, with good correlation between actual and estimated values of Q for both 6 and 10 (correlation constant $r = 0.67$) (Snedecor[10], p. 138).

The statistical method is a sensitive one and provides formulas that reflect the experimental findings fairly accurately. There is one major problem, however, which is hard to explain and which indicates that the method should be used on larger samples of houses than Glen. A 60- to 75-house sample would probably give significantly better results.

Equation 8 is similar in form to 1 and to 7. Not so with 9. The V factor virtually disappears and the G factor takes on an importance far out of line with G in the other equations.

It can be argued that: (a) Mt. Diablo cuts off the sun from Monte Gardens in the early morning, while the wind can come in from the bay across flat country, hence equation 6. (b) The houses along Glen road are more sheltered from the wind and more open to the morning sun, hence equation 10. (c) It is also true that the sky radiation readings were taken at a point between the two test areas and, when checked, gave only an approximation of actual test conditions at the test sites. (d) Equations based on data taken at the earliest times (2 and 8) and taken on mornings of maximum peaks 5 and 9) when G is low, show a plus G factor. There was fog on many of the mornings. It has been theorized that early sun may clear away some of the fog and bring on a temporary condition of increased heat loss from the houses. Conversely, when data is included for warmer mornings of lower peak loads, then the G factor diminishes in importance (Eqs. 1 and 7).

Summary

The results obtained in this field test are adequate for use in meeting peak demand and master planning. The greatest importance of this study is to highlight the method of analysis. The actual information obtained remains to be augmented by similar material from other sections of the region. Further tests are necessary to find out more about the times and places in which V and G are important. Simplified curves such as *Figs. 2 and 3* can be prepared for other and larger areas. Graphical scales can be prepared transposing load per customer data into total load figures, and finally, factors can be added for commercial and industrial load. This is not a difficult job, but a job that will take planning in the field and a fresh, creative approach.

Conclusions

The origin of this study lay in the efforts on the part of our Contra Costa

TABLE 13. Summary of Equations

Equation Number	Equation	Remarks
	Granada	
(1)	$\hat{Q}_1 = 0.66\,T + 0.43\,V - 0.018\,G + 14.4$	$n = 52$, $Q \geqq 16$
(2)	$\hat{Q}_1 = 1.30\,T + 0.77\,V + 0.34\,G - 39.9$	$n = 52$, $Q \geqq 16$ T, G = peak time − 2 hrs.
(3)	$\hat{Q}_2 = -0.53\,T' + 0.36\,V - 0.076\,G + 61.4$	$n = 52$, $Q \geqq 16$ T′ = actual °F
(4)	$\hat{Q}_2 = -0.53\,T' + 0.36\,V - 0.076\,G + 62.6$	($n = 33$) $Q \geqq 30$
(5)	$\hat{Q}_1 = 0.59\,T + 1.05\,V + 0.0079\,G + 13$	$n = 33$, $Q \geqq 30$
(6)	$\hat{Q}_1 = 0.59\,T + 1.95\,\sqrt{V} + 14$	Simplified form of (5) Fits data better.
	Glen	
(7)	$\hat{Q}_1 = 2.05\,T + 2.53\,V - 0.016\,G + 20.8$	$n = 40$, $Q \geqq 34$
(8)	$\hat{Q}_1 = 1.85\,T + 2.27\,V + 0.016\,G + 23.8$	$n = 40$, $Q \geqq 34$ T, G = peak time − 2 hrs.
(9)	$\hat{Q}_1 = 0.53\,T + 0.077\,V + 0.115\,G + 68.1$	$n = 21$, $Q \geqq 90$
(10)	$\hat{Q}_1 = 0.53\,T + 0.115\,G + 68.1$	Simplified form of (8)

Q_1 is derived by one-step method, cf/hr/cust.
Q_2 is derived by three-step method.
T = 70 minus actual °F at time of peak-load.
V = 30-minute average wind velocity, mph.
G = 30-minute average sky radiation, Btu/hr ft².
n = number of days of data upon which equation is based.

region gas department to combine both a scientific and a readily applicable method of forecasting load for a given distribution area, for some future design date. Detailed load forecasting has become more necessary in order to do an adequate job of master planning and to analyze proposals for new large feeder mains.

This study has brought out information concerning two test areas, which information proceeds along several lines: (1) customer usage, (2) load per acre, (3) physical characteristics of houses in the test area, and (4) relative effect of temperature, wind and sky radiation on load.

There are certain aspects of a "model" sample study which have not been included in this paper. It remains for a summer test, for example, to determine (a) the lowest summer minimum load, (b) the pilot load only for a test area, and (c) a morning cooking and washing load with no space heating.

It is desirable to measure pressure drop across the test area at peak load times. This information can be used to check estimated pressure drop and load distribution in an area such as Monte Gardens. A check can be made between the Polyflow computer results and actual performance of mains in the distribution system. This latter pressure drop information was obtained during this study, but a review of the results is considered to be outside the scope of the paper.

Operationally it is a simple task to install a meter, sample the customers in the test area, and thereby obtain the information under (1), (2) and (3) above. The important decision is to determine what type of analysis is desirable for the particular circumstances. The simplest installation would include instruments to measure peak load and temperature at the peak time. In order to obtain further data necessary for a four-variable analysis (including the interdependent variables of temperature, wind velocity and sky radiation), two sets of instruments would have to be added—anemometer and flat plate radiometer. It may become apparent with further investigation that the G factor can be dropped and V can be estimated by some simple expedient such as checking with the nearest official Weather Bureau station.

It is necessary that two types of data be obtained at the same time: (1) actual loads, and (2) load response to meteorological conditions (for determining design peak loads). In conclusion, we reiterate that this paper (1) presents concrete operating data oriented toward the establishing of "customer profiles" of gas consumption in the region and (2) suggests the development of a four-variable analysis to determine design peak loads.

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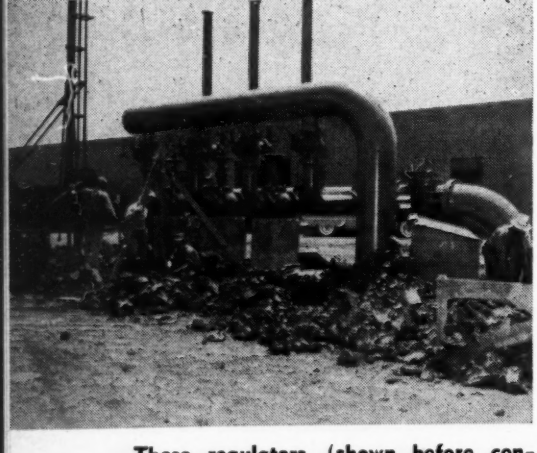
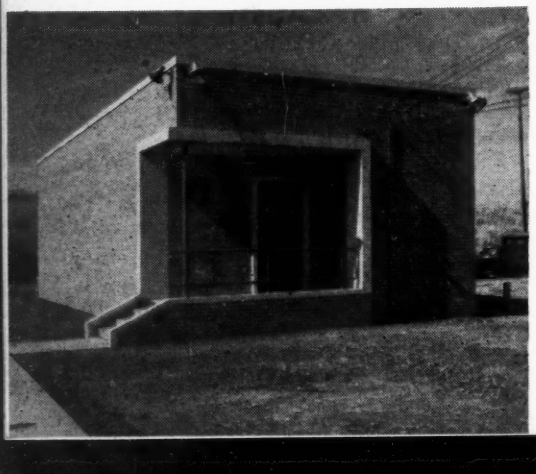


These regulators (shown before construction of the building) made a terrific noise as they reduced incoming pressure.



Now, heavy acoustic insulation has made this station practically soundproof.

Music OK, But Not Singing Gas

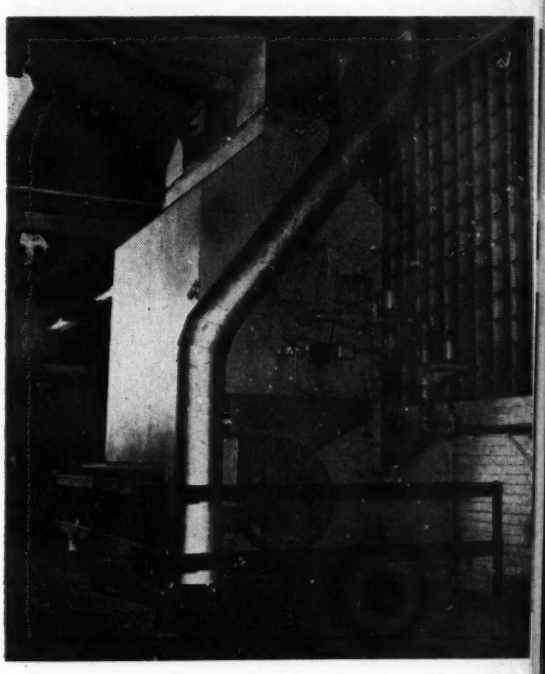
FACED with a noise problem in their new city gate regulating station in the heart of the Dallas industrial district, Lone Star Gas Co. engineers solved it by making the building practically soundproof.

Deed restrictions in the industrial area (along the Trinity river) specified "no obnoxious odors or noises." To comply with these restrictions Lone Star engineers had to muffle a terrific noise created by the "singing" gas as it was reduced from 200 to 25 psi. Natural gas flows into the station from a 20-in. transmission line and three regulators drop the pressure to intermediate pressures of 25 to 50 psi. From the station gas flows to downtown Dallas through two 24-in. lines.

Constructed of solid masonry, the building is designed to blend with the modern architecture of adjacent industrial buildings. The walls and ceiling are insulated with 3-in. thick acoustic material. Both front and rear entrances have double doors, the inner door being insulated with acoustic blocks. Airshaft noises are killed by 1-in.-thick acoustic sheets on 6-in. centers. To eliminate vibration and further reduce the possibility of noise, the floor is not attached to the building. A separate room houses the measuring instruments and the entire structure is ventilated by fans.

Completed in September 1952, this is the first regulating station of its type for the Lone Star Gas system. And with a little dressing up, it makes a very attractive modern landmark.

Air-Tempering Space Heaters Remove Plating Shop Fumes



End view of one of the heaters. Fresh air is drawn through the wall duct at right and after being heated to the proper temperature is discharged into the shop through the four louvered outlets at top.

MAXIMUM efficiency in removing toxic fumes from metal plating operations to assure a safe and comfortable working atmosphere has been achieved by the Wagner Electric Corp., St. Louis, by the installation of two air-tempering, direct-fired space heaters in the plating shop.

Exclusive

The problem confronting the company's plant engineers was how to replace large volumes of air which had to be exhausted to carry off fumes in the plating building. It was not critical in warm weather when air entered open windows and doors for natural ventilation, but during the winter, cold outside air would chill the working area and make it uncomfortable.

To solve this problem, two gas-fired Dravo Counterflo heaters were installed, one against the south wall and one against the northwest wall. Both take their air supply from the outside through louvered wall openings and discharge heated air during cold weather and fresh air during warm weather into the working area. Each heater has a capacity output of 2,000,000 Btu per hour and handles approximately 22,000 cu ft of air per minute.

Control for each heater is a thermostat which actuates a modulator for the gas burner in accordance with temperature requirements. The heaters thus provide a constant supply of some 44,000 cu ft of fresh air per minute, the air being tempered in the winter so it does not chill the building interior. The heater fans are also operated in warm weather (with the burners off) to circulate fresh air brought in from the outside.

Introducing this large volume of fresh air into the building prevents ventilating equipment from causing negative pressure which retards the efficiency of gas-burning devices and slows down the exhausting of fumes.

Ducts from three 30-in. American Blower turbo-pressure blowers provide individual venting for tanks and plating equipment. Some of the ducts are hooded; others terminate at points where fumes are given off. Fumes from the remainder of the shop are exhausted by one 42-in. roof ventilator, three 24-in. roof ventilators, and several gravity ventilators.

The Dravo Counterflo heater has a stainless steel combustion chamber which has proved particularly advantageous at this Wagner Electric plant. First, stainless steel resists any corrosion from moisture-laden air brought in from the outside. Second, it permits quick delivery of heat from a "cold start," enabling the company to shut down the heaters and conserve fuel during non-working hours with the assurance that warm air can be supplied as soon as the department resumes work.

The heaters are fully automatic, require no attendant, and their installation consisted merely of installing a fuel line, power line, vent stack, and wall openings for the air intake.

In operation, air enters the base of the heater casing and first passes over two staggered banks of economizer tubes carrying exhaust gases to the vent stack. In this way, the heat value remaining in the gases is utilized. Inside the tubes are twisted "swirlers" that swirl the gases to make heat transfer more effective. After passing over the tubes, air then sweeps the stainless steel combustion chamber and is discharged through four louvered outlets on top of the heater casing. The outlets can be adjusted to control the direction of air flow from the heaters.

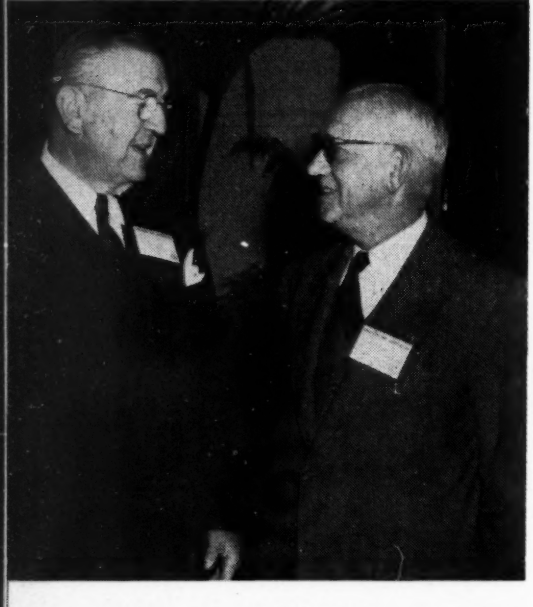
At Wagner Electric, plating operations have improved the appearance and lengthened the service life of component parts manufactured for automotive brake systems.

Component parts before they are plated are electrically cleaned, rinsed, pickled, and rinsed again, then zinc plated and rinsed once more before given a bright dip in 1% nitric acid solution. For aluminum, a 20% sulfuric acid solution is used. In pickling, a 5% sulfuric acid bath is employed.

This louvered opening admits fresh air to the heater which supplies large volumes of heated air to replace fume-laden air exhausted by the ventilators. In summer, the air is circulated without heating.

Convention Speakers Predict Bright Future for Gas Industry

The registration desk was jammed as over 8000 gasmen registered for the convention.



Reelected treasurer Barrett and outgoing president Bennett.

WITH some 8000 persons in attendance, the three-ring circus that is the combined biennial AGA convention and GAMA exhibition met in Atlantic City Oct. 27-30. Program subjects ran the gamut from free enterprise and government regulation through sales problems and technical problems of such considerations as the role of women in management. Entertainment ranged from the selection of beautiful Linda Lombard as "Miss Gas Flame of 1952" to the president's reception and the usual parties by the largest gas manufacturers in the business.

There were many lookers into the future. A short-term look was taken by such persons as Louis Ruthenburg, retiring president of GAMA, speaking on "Whence, Whither and How?"; Frank C. Smith, new AGA president, talking on the big question of the day, merchandising; and C. E. Bennett, retiring president of the AGA, speaking on "Where Will We Be in '53?"

The long-term view, and it is a bright one, was given by Dr. Gustav Egloff, director of research for Universal Oil Products Co. in Chicago, who in telling of the place of natural gas—present and future—carried his listeners on a trip through the next quarter century.

Dr. Egloff's long-term look at the future of the gas industry was directed more specifically toward the markets for natural gas liquids and products, including the fast growing field of synthetics and petro-chemistry. Speaking first on the outlook for the immediate future he said: "It is the goal of the Petroleum Administration for Defense to increase natural gasoline capacity to 365 million barrels a year by the end of 1953. The goal of PAD could be met by recovering more of the natural gas liquids from our present production of natural gas, which it is estimated could yield another 150 million barrels of liquids besides those that are already being produced.

"At present one-third of L.P. gas production is from natural gas operations and two-thirds is recovered from crude oil refining. Sold as a constituent of natural gas, L.P. gas has a value of less than one cent a gallon, but separated, it can be marketed for an average price of about 5 cents a gallon which raises the value of gas 4 cents per Mcf for each gallon received. If our estimated 1975 gas production of 15 trillion cu ft were all processed for such an L.P. gas recovery, it could mean an added gross income to the natural gas industry of $400 million a year over the present figure of around $200 million.

"It is important," said Dr. Egloff, "to point out that natural gas has been discovered at a much faster rate than petroleum and natural gas liquids in recent years. If this trend continues to 1960, our cumulative discoveries of natural gas on a thermal basis will be 55% of the total liquid and gaseous hydrocarbon discovery, whereas in 1950 they were only 30%. On a thermal basis, there is about the same amount of heat energy in our present proved reserves of natural gas as there is in our proved reserves of liquid hydrocarbons, which include oil and natural gas liquids . . .

"Natural gas is also a major raw material for the skyrocketing $2 billion petro-chemical industry, which now supplies 25% of the total chemical requirements and is expected to be the source of 50% within 10 years. Total petro-chemical requirements are predicted to be in the order of 55 billion pounds in 1960 and 70 billion in 1975 . . .

"Despite the gigantic demands that will arise for petro-chemical products, only a small percentage of our total natural gas production will be used to meet the estimated requirements. As far as can be predicted, ample supplies of gas will be available for space heating, cooking, industrial and other uses."

The story of "Government Regulation: A Threat to Free Enterprise" was told by Herbert R. O'Conor, Democratic senator from Maryland and one of the small tribe of friends of the gas industry from a non-gas-producing state.

Showing a deep appreciation of the history of the gas industry and the utility industry under a growing federal domination, Senator O'Conor traced the growth of federal regulation since 1914. He dwelt on the story of the Tennessee Valley Authority that began in 1933 when the federal government set it up for the purpose of operating Wilson dam. Since then the federal government has gone into the field of public power on a giant scale and now owns more than 14,000 miles of federal power lines throughout the U. S. with further great expansion of facilities planned.

"Despite protestation that no harm would be done [by TVA] to the electric companies in the area, it is now shown that 31 investor-owned companies formerly operating there have been replaced in whole or in part, nor are its sponsors satisfied even now. The Authority continues to expand its monopoly."

In speaking of regulation in general, Senator O'Conor said, "The natural inclination is to ask, why is regulation necessary at all? The answer that has been presented by scholars, who have manifested a deep interest in the public utility field, is brief, to the point and sobering. These men feel that the alternative to commission regulation, whether at the state or local level, is a public demand for outright ownership of the utilities by the government. Certainly regulation is the lesser of the two evils presented here."

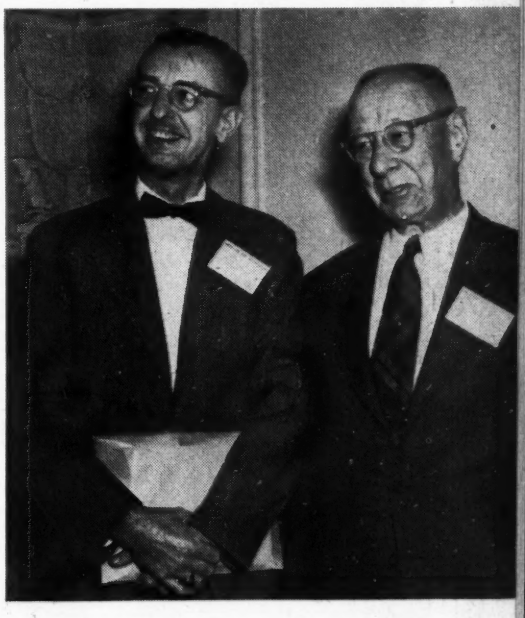
The senator also gave an excellent comparison of the different philosophies of the state and federal regulation and pointed out how, in the main, state regulation is much fairer than that of the federal government.

Said Mr. Bennett, "Today the gas industry in the United States is facing the most serious challenge in its history. Its general condition at the present time is excellent, but our achievements in recent years have made us most vulnerable. Every leader is vulnerable and we are no exception. Gales of competition swirl around us. Competition for steel, for manpower, for increased rates, for the investment dollar is not relaxing. Great competition surrounds the sale of our fuel, its appliances and its related equipment."

Regardless of all the problems, the industry has "the greatest opportunity in its history to continue its phenomenal progress if we recognize the danger signals," he continued. Among the other ifs in this proposition was, "if we build our American Gas Assn. into an even stronger trade association than it is today . . . [The AGA] does not seek eminence; it does not speak for members, it is members speaking for their own industry. The devotion of the members of 306 committees in working up a free interchange of ideas, policies, opinions, and practices, has been a bulwark of strength to the industry as a whole."

Having allotted himself only time for a brief recounting of some of the achievements and problems of the AGA, Mr. Bennett made a strong plea for more

Eskil Bjork, Peoples Gas; David Moore, U. of Chicago; and Dwight Sargent, ConEd and chairman of personnel committee, at personnel relations session.



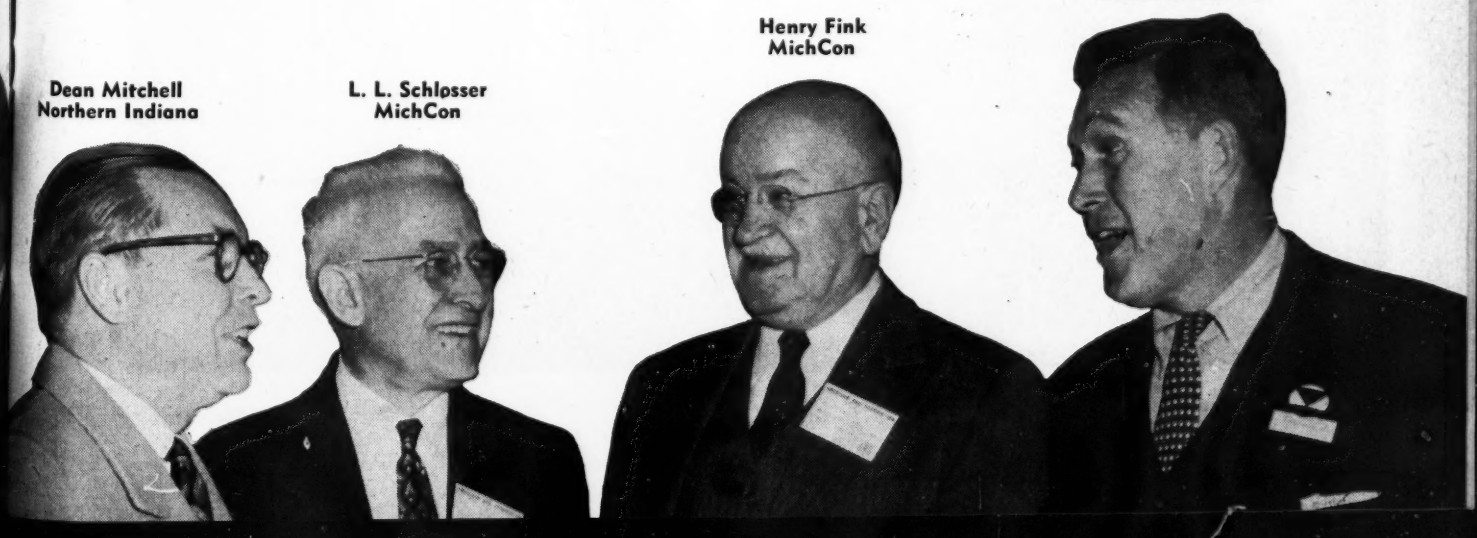
Channing Wilson, Consolidated Gas, and H. Bruce Anderson, Philadelphia Gas Works, incoming and outgoing chairman of operating section, respectively.

C. B. Dushane
American Meter

Henry Fink
MichCon

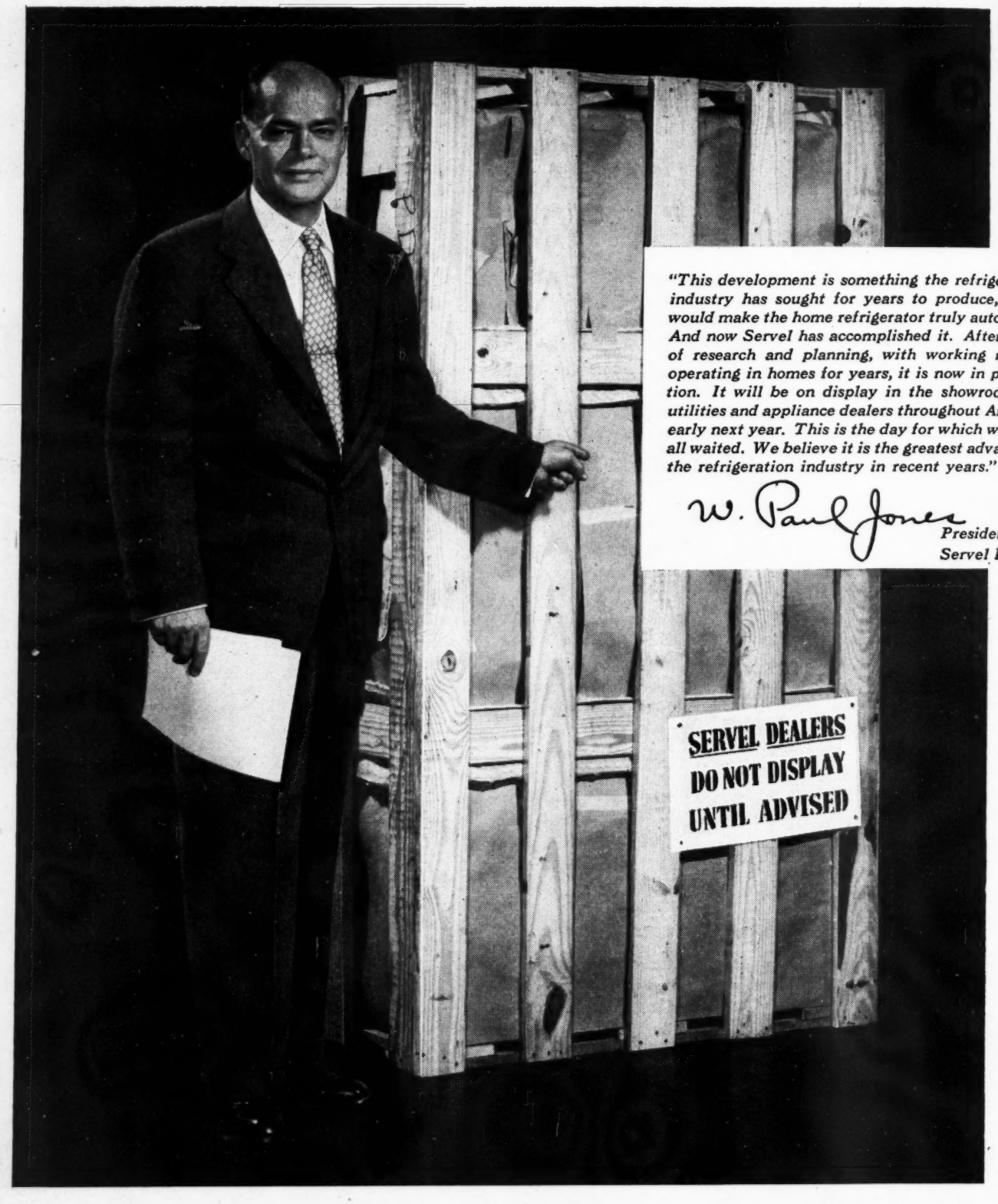
Dean Mitchell
Northern Indiana

L. L. Schlosser
MichCon



A MESSAGE OF VITAL IMPORTANCE TO THE

"This refrigerator



"This development is something the refrigeration industry has sought for years to produce, for it would make the home refrigerator truly automatic. And now Servel has accomplished it. After years of research and planning, with working models operating in homes for years, it is now in production. It will be on display in the showrooms of utilities and appliance dealers throughout America early next year. This is the day for which we have all waited. We believe it is the greatest advance in the refrigeration industry in recent years."

W. Paul Jones
President
Servel Inc.

will obsolete every other refrigerator in America today!"

"For the first time in history, a home refrigerator makes ice cubes without messy trays — puts them in a basket — and replaces them as you use them — all automatically! It's a new and great opportunity to guarantee your kitchen load!"

THINK of having a story like this to give a refrigerator prospect! No messy trays to fill or spill. No trays to empty or forget to refill! You simply reach in and help yourself to cubes, one at a time or by the handful. As you take them out, Servel puts them back! No muss, no fuss — everything's automatic!

And these are not just ordinary cubes. They're big, dry, super-cold *IceCircles*, that last longer . . . won't stick together even during automatic defrosting!

To all this add the *dependability* of gas — the *silence* of Servel's famous motorless Permacold Freezing System — and today's only *10-Year Refrigerator Warranty*. Add every modern refrigerator feature from Automatic Defrosting to 80-lb. Freezer Compartment. Add the power of the largest and most aggressive national advertising campaign in Servel history — and you know why the new Servels will be the most wanted refrigerators in America this coming Spring!

1953 — Opportunity Year

With one giant stride, Servel's Automatic Ice-Maker puts you head and shoulders above your refrigerator competition. It gives you a golden opportunity to seize a greater-than-ever share of the market — as well as a golden opportunity to increase your year-round kitchen load this coming year!

In other ways, too, Servel will be helping to build your year-round load in 1953. Now, mass production will put the Servel All-Year Air Conditioners well within the reach of the average home buyer. Imagine the big, wide-open market for a simple, low-priced unit that heats a house in winter and cools it in summer — all with dependable *gas!* In commercial buildings, stores, restaurants and industrial plants too, there is a real load-building opportunity for you with silent, vibrationless Servel All-Year Air Conditioning systems!

And gallon-for-gallon, Servel Copper Ball Gas Water Heaters give you the most efficient unit ever designed!

Curtain Going Up!

Already, over 40 million Americans have been given a preview of Servel's amazing new Automatic Ice-Maker Refrigerator and Servel's other great new product developments via 2-page spreads in the November 24th LIFE and the November 22nd SATURDAY EVENING POST.

In 1953, with the sensational Automatic Ice-Maker Refrigerator paving the way, Servel will be far in front of the field. With other equally sensational advancements already in the planning stage — and with your help — we intend to stay there.

Servel

The name to watch for great advances in
REFRIGERATION and AIR CONDITIONING

Servel Inc., Evansville 20, Indiana • In Canada, Servel (Canada) Ltd., 548 King Street W., Toronto, Ontario

PAR plan funds. In speaking of promotion, he pointed out that nine well-planned and efficiently executed merchandising campaigns for appliances have been set up. He mentioned the 45 research projects in technical fields of utilization, production and transmission that are under way in the research portion of the PAR program. He spoke of the lag in utilizing the results of some of our domestic research and of the need for speeding the flow from research laboratory and development laboratory to the product.

Taking as his title "That Is The Question," Frank C. Smith spoke of the real need for even closer cooperation between utilities and manufacturers particularly as concerns support given by the utilities to their manufacturer friends.

"Our two organizations," he said, "have closed ranks and locked arms, but these associations can advance only as far as their components—gas utilities and gas appliance manufacturers—are willing to go. If we will reassert and undertake throughout *our* industry, the continuance of our responsibility for leadership in gas appliance marketing, the appliance manufacturers will not fail us. If we do not, the trend won't be to gas. The trend will be to an appliance manufacturing industry with less and less accent on gas."

Excerpts from other major addresses will be found on the following pages.

Outstanding Achievements Recognized

The traditional awards were presented at the general session on Tuesday. Frank J. Hall, superintendent of distribution plant, Michigan Consolidated Gas Co., Detroit, received the Distribution Achievement Award sponsored by the American Meter Co., Philadelphia.

The presentation marked the initial bestowal of this award, which consists of a certificate of merit and a cash emolument of $1000. It is to be presented each year to the person judged to have made the most outstanding contribution to the science and art of gas distribution, either during the past year or during the past five years. Mr. Hall received the award for his prominent part in the development of lightweight service trenchers.

Everett L. McDougal, construction foreman and welder, Pacific Lighting Gas Supply Co., Los Angeles, was awarded the highest honor that the gas industry can bestow upon an individual for outstanding bravery when he was presented with the Meritorious Service Medal.

The award, a gold medal and a button and a certificate of merit, was given for McDougal's conspicuous presence of mind and bravery on June 25, 1952 in rescuing a fellow worker from a burning gas line in an excavation where a drip was being installed.

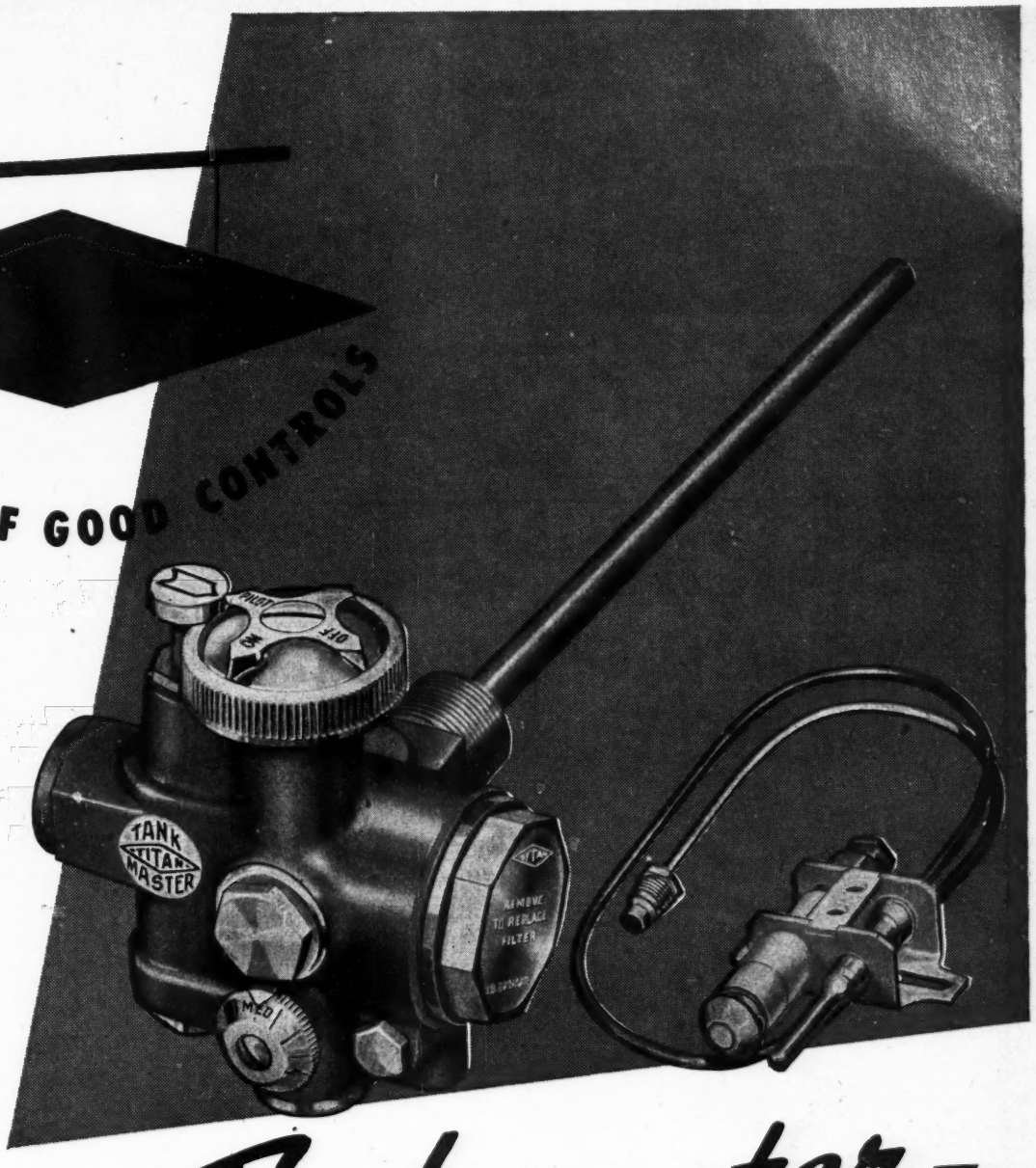
Other award winners are pictured below and at right.

Jack W. Carroll, assistant superintendent of production, Philadelphia Electric Co., was given one of the highest honors possible in the gas industry when he was presented with the Beal Medal and a cash award for preparing the best technical paper presented at an AGA meeting this year. President Bennett (left) is shown making the presentation. He was given the award for a paper titled "Economics of Peak-Shaving," which was presented at the production and chemical conference sponsored by the operating section of AGA in New York City in May.

Recognition for outstanding accomplishments in the home service field was given to five winners in the AGA Home Service Achievement Award sponsored by **McCall's** Magazine. Cash prizes totaling $1000 and bronze plaques were awarded to individual members of home service organizations who were considered to have made the most effective contribution to the advancement of modern homemaking by promoting the use of gas and modern gas equipment. Recipients (l to r) were: Wanda M. Ewing, United Fuel Gas Co.; Ruth Sheldon, Washington Gas Light Co.; Elyse Van Dyke, Alabama Gas Corp.; Ann Worden, Michigan Consolidated Gas Co.; and Jean Hughes (not shown), United Gas Corp.

Representatives of winning gas companies in AGA-Servel "Open the Door" gas refrigerator campaign for sales managers hold their prizes, "perpetual motion" clocks. Front row (l to r): E. A. Brown, Union Gas System Inc.; S. V. O'Lenic, Chattanooga Gas Co.; W. Paul Jones, president of Servel, who made the awards; A. E. Hatley, Central Indiana Gas Co.; Howard Valentine, Peoples Gas Light & Coke Co. Back row: W. Q. Kringle, Southern California Gas Co.; J. H. Chenery, Alabama Gas Corp.; Hugh L. Wathen, South Jersey Gas Co.; C. H. Zachry, Southern Union Gas Co.; A. T. Johnson Jr., United Gas Corp.; W. J. Pomar, St. Augustine Gas Co.; C. B. Reinschmidt, Savannah Gas Co.; Joseph E. Walsh, Metropolitan Utilities District.

THE SIGN OF GOOD CONTROLS



Titan Tankmaster -

THE OUTSTANDING TITAN CONTROL

OUTSTANDING because of the large capacity and the extra large, removable filter.

OUTSTANDING because of the metal to metal valve and seat—a real engineering triumph.

OUTSTANDING because it is designed for use with all gases—through the TITAN Snap Action Mechanism—and with 100% Safety Pilot and Safe Lighting.

TITAN TANKMASTER will give *outstanding* service to your customers.

Write for specifications and complete information.

THE TITAN VALVE & MANUFACTURING COMPANY

9913 ELK AVENUE • CLEVELAND 8, OHIO

All smiles are Frank Smith, new AGA president, and H. P. Stellwagen, Indemnity Insurance Co.

Convention Reports

Excerpts and abstracts from major AGA convention speeches.

General

Whence? Whither? How?

by Louis Ruthenburg

"In the circumstances that have characterized the gas industry during the post-war years, management has dealt with one emergency after another. In some it has become a fire-fighting rather than an administrative function. Under such conditions, many gas utility managements have relegated the preservation and development of residential load to a position of low priority . . .

"Examination of case histories leads to several interesting conclusions . . . [among which is that] appliance manufacturers cannot survive in the presence of a *few* exceptional markets of limited potential. Their fortunes are determined by *national* trends . . .

"The top executive who has resolved to preserve the basic load will encounter many high hurdles. But always the challenge can be answered by the simple fact that it can be done because it is being done.

"He will be told salesmen cannot be hired, trained and held . . . that you can't get production out of a unionized sales force . . . [But] as he studies case records [he will learn] that 'insured' service by the utility is a most effective sales tool . . .

"When the gas appliance salesman can say to his prospect, 'The utility will service your gas appliance,' sales resistance is reduced to a minimum because the utility is generally regarded as the symbol of *permanent* responsibility . . .

"Utilities engaged in appliance merchandising are more keenly aware of customer requirements . . . than utilities that do not merchandise."

That Is The Question

by Frank C. Smith

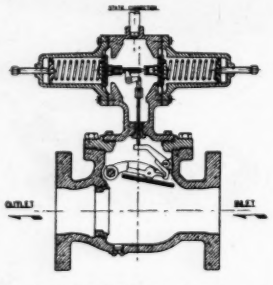
"No segment—no company—in our industry . . . can afford to coast . . . the problem of problems [is] the threatened loss of our market for the sale of gas at its highest price . . . its basic load . . . I mean the household load . . . the kitchen load . . . without which you have no backbone . . . "

Mr. Smith compared the gas utility industry and the appliance manufacturing industry to two brothers who are so close that what affects one affects the other.

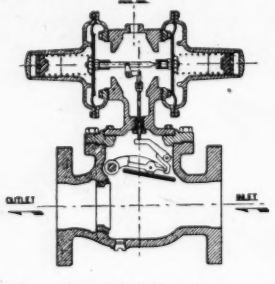
"How do the brothers stand today?" he asked. "The gas utility industry was never more vigorous, but what of the gas appliance manufacturing industry?" He went on to quote from the talk by Lyle

THERE IS A *Security* AUTOMATIC SHUT-OFF VALVE FOR EVERY REQUIREMENT

Security Automatic Shut-Off Valves will provide automatic shut-off in the event of either increase or decrease in pressure. Installation may be upstream or downstream (in relation to the regulator), with or without static line control, for either high or low pressure application.

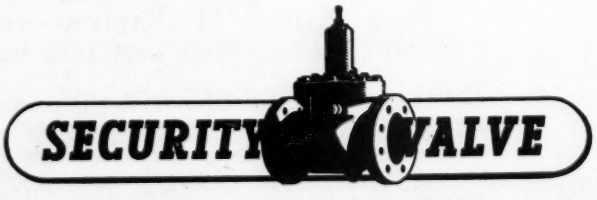


MODEL "IDPS-H" (closes on Increase *or* Decrease in Pressure; Static line control. High pressure application).



MODEL "IDPS-L" (closes on Increase *or* Decrease in Pressure; Static line control. Low pressure application).

Write for New Comprehensive Bulletin



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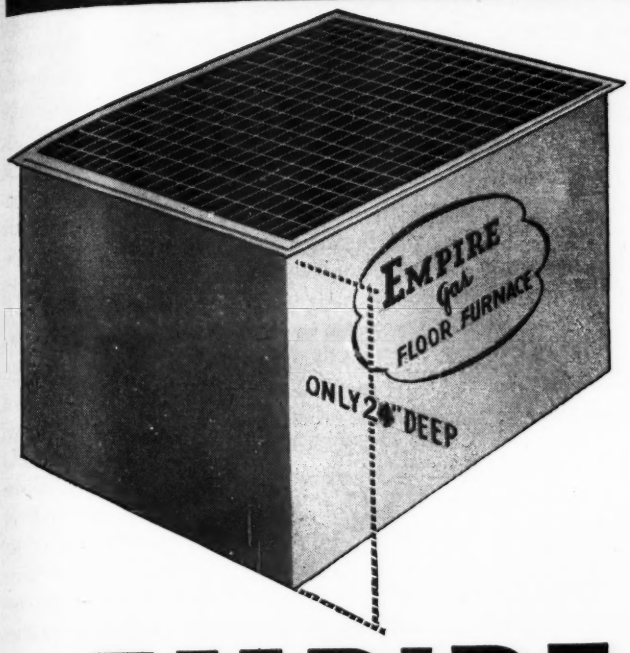
EMPIRE THE *Gas* FLOOR FURNACES WITH A POWERFUL SALES PUNCH

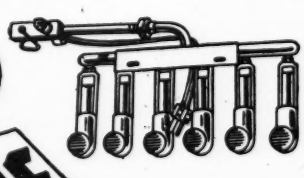


EMPIRE *Gas* FLOOR FURNACES

EXCLUSIVE WITH EMPIRE

The FAMED

"Thriftmatic" *Gas* BURNER



OFFER FEATURES THAT WILL SELL

- Greater Efficiency
- More Comfort
- Longer Life of Appliance
- Smaller Fuel Costs
- Lower Installation Costs
- Fewer Service Calls

SEE YOUR LOCAL EMPIRE REPRESENTATIVE OR WRITE DIRECT TO EMPIRE

EMPIRE STOVE COMPANY

BELLEVILLE, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF *Gas* FLOOR FURNACES

Some of the VIP's talk it over. (L to R) J. T. Wolfe, Consolidated Gas; Tom Walker, Irving Trust Co.; Senator O'Conor; Louis Ruthenburg; and F. H. Adams of Surface Combustion.

Harvey* and then recapitulated the events that "together with our failure wholly to unite our industry have operated to bring us to the dire necessity of [Mr. Harvey's] appraisal." He called the buyer's market the "great awakening."

Admitting that the gas appliance manufacturing industry has lived up to its responsibilities, Mr. Smith stated that it was the manufacturer who "got it squarely in the neck" when the encroachment of competitive appliances in the buyers' market reached its present intensity. Finally, five months ago, the executive board of AGA invited the executive board of GAMA to join in a conference and study of mutual problems. This invitation was immediately accepted.

"Last month these task committees . . . agreed on recommendations each to its own executive board. The executive boards of the American Gas Assn. and GAMA are to have before them, in a matter of days, joint recommendations made by these committees that will constitute the elements of a program of united action on those fronts of mutual concern.

"So we have come at long last—and by 'we' I mean the two branches of our great industry—to the place where we should have started."

Finally, he asked three questions: "Is a healthy, profitable gas appliance manufacturing industry an absolute essential to the gas utility industry, and should our investors be concerned that this essential is secured?

"Is gas appliance sales leadership by the utility the absolute essential for a healthy, profitable gas appliance manufacturing industry?

"Is appliance sales leadership the direct, inescapable responsibility of the gas utility industry?

"I'll answer these, 'Yes,' in firm, heartfelt conviction that the answer is right. But—will the utilities' management, beginning at the top, see to it that we maintain our markets and survive? *That* is the question. *You* answer that one."

*GAS, September 1952.

Government Regulation — A Threat To Free Enterprise

by Herbert R. O'Conor

"From small beginnings the tide of federal regulations has swelled continually. Prior to 1914, federal regulation of public utilities was relatively insignificant. The real assault, however, the current flood of federal encroachments on state regulations, did not begin until 1933. After that the FPC, the FCC and the SEC, as well as other agencies, were formed . . .

"There are several differences between state and federal regulation that should be noted. First, state commissions are older and more mature than their federal counterpart, and like human beings at maturity, they tend to be somewhat more cautious about disturbing relationships and somewhat more judicial in approach. The second difference is the fact that, in general the federal government is so constituted that its executive elements are all headed up by the Chief Executive. Presidential leadership often extends to some degree to the legislative branch, while it is of small consequence to the judicial branch. Third, in the state pattern of organization, there is considered to be no necessary connection between the nature of the job to be done and the degree of independence granted the unit. In the fourth place, the staff of federal regulatory organizations is invariably larger than the staff of state units. Fifth, the Congress sits more frequently and for longer periods than does the average state legislature. The impact that is brought to bear on the federal commission by the legislative and executive branches is more continuous and much more effective than the influence that can be brought to bear ordinarily by the executive and legislative branches of a particular state on a state commission. Finally, the average person feels

GAMA Exposition Draws Thousands

A water heater that provides two different temperatures of hot water simultaneously, tinted appliances that blend with wall decorations, and individually tailored automatic gas ranges were among the boons to the housewife unveiled at the GAMA exposition.

Gas ranges are now available in every size as well as a wide variety of colors ranging from gigantic 6-burner models to space-saving 30-in. ranges designed for apartment living. Some ranges even come in separate units so that the oven and burners can be separated if the kitchen arrangement makes it necessary. Additional features include removable doors for easy cleaning, automatic ignition, and interior lighting.

The new two-temperature water heater, known as the Duo-Temp, was introduced by the Ruud Manufacturing Co. A separate line can be run to an automatic clothes washer and/or dishwasher from a 180° outlet while another line supplies water at 125° for general home bathing use.

More automatic gas clothes dryers were in evidence at the exhibit than ever before. Two range manufacturers, Roper and Caloric, announced their invasion of the field at the exposition. Some of the new dryers have ultra-violet lamps to give clothes an "out-of-doors freshness." Other innovations include interior lights that turn off automatically and safety doors that shut off the burner instantly when they are opened.

Empire Stove Co. unveiled a complete new line of recessed wall heating units as well as their new models of gas floor furnaces. The company also announced plans for a new suspended type central heating unit, a new basement unit, a new closet type unit, and a perimeter central heating unit. In the future the company will produce only gas heating appliances as they are discontinuing their line of gas ranges.

Among the non-appliance exhibits that attracted considerable attention was the one of Aqua-Seal Inc., a paint manufacturer. This company is marketing a special paint used by ConEd in its new flotation method of painting water-seal holders. A brief movie showed the various steps.

much more remote from the federal agencies than from those at the state level.

"There are weaknesses that have developed in the federal regulatory system. One of these is the fact that there is a chain reaction leading to multiple cases, all of which spring from a single decision. This is owing to the manner in which private utility companies operate at varying commercial states.

"Another weakness is that, at the federal level, commissions concern themselves with estimates of conditions that will prevail in the future. State commissions are more prone to deal only with existing facts."

Looking into the future, the senator predicted that the demand for gas will continue to increase in spite of the fact that taxes, costs, wages, and consequently gas rates will go up. Materials will continue in short supply and investors' dollars will become even more competitive with securities of other industries and the government. He also predicted that public opposition to rate increases will grow and that selling and promotion will receive more attention.

Speaking of the famous East Ohio Gas Co. case, he told of progress on a bill that he and Senator Bricker of Ohio have introduced into the Senate to take away the dual federal-state regulation that the courts' interpretation of the case now makes possible. "We secured a favorable report from our Senate commerce committee and the bill came before the Senate on July 5. The bill was passed by the Senate and is now before the House. It will not be acted upon before the new Congress convenes.

"I am firmly of the belief that local distributing companies should not come under the jurisdiction of FPC, but should be subject to local regulation only."

Safety

by E. H. Eacker

"The AGA has 17 different committees giving study to its safety and accident prevention program. Complementing these are 16 subcommittees of the accident prevention committee and 23 subcommittees of the approval requirements committee. That is a total of 56 major and sub-groups. Why, out of 40 industries do we stand 32nd in frequency rate and 24th in severity rate?

"I know how conscientious many of our companies are in reporting accidents and lost time, as they properly should be reported. I have also heard of the subterfuges used by some companies, which are not members of our industry, to better the appearance of their safety record. I also know that there is the matter of the minor aspects of accidents to be considered, as well as the costs. Nonetheless, I am puzzled and worried over the matter of safety and accident prevention.

"There are puzzling characteristics of the safety problem, including the question as to how one company can greatly improve its safety record, while another company is unable to improve it. We must use every means to find the answers to these puzzling characteristics. The accident prevention committee should study the records of companies, such as Washington Gas Light Co., which have materially bettered their safety record and report to us the methods that have been employed to bring about these marked improvements."

Mr. Eacker also presented an organization chart of AGA committees concerned with safety and accident prevention in 1952, showing the general committees, committees of the natural gas department and the manufactured department, the committees of the AGA laboratories and the committees of the operating section and of the industrial and commercial gas section.

Maxitrol
RV-10-1/8"
GAS PILOT PRESSURE REGULATOR
A Rx FOR SERVICE CALL BUGABOOS!
Service Calls, the bugaboos of the industry . . . costly, time-consuming, unnecessary!
You can eliminate much of this wasteful effort by installing the new Maxitrol RV-10-1/8" gas pilot pressure regulator. It makes sense. This mighty little regulator, only slightly larger in diameter than a silver dollar, assures accurate and efficient pilot operation regardless of fluctuating pressure conditions!
Investigate the advantages of installing the RV-10-1/8" on your gas fired boilers, furnaces, conversion burners, hot water heaters and ranges. Let Maxitrol be your customer "goodwill ambassador."
Maxitrol IS BEST, BY FAR!
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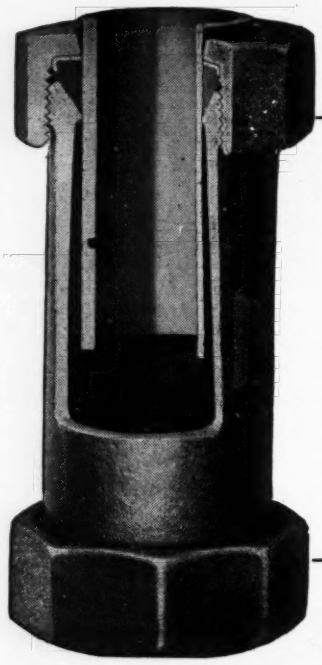
DETROIT REGULATOR CO.
1742 RIVARD STREET DETROIT 7, MICHIGAN
Sold on the Pacific Coast by: PACIFIC SCIENTIFIC COMPANY
San Francisco, Los Angeles, Seattle, Portland



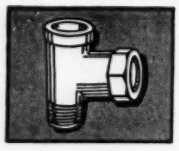
NORMAC

Couplings, Sleeves and Fittings

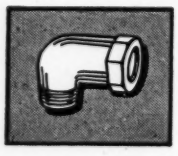
for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

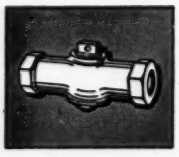
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.



Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.



Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.



Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

Where Will We Be In '53?

by C. E. Bennett

Keeping pace with the fast growth of the gas industry, "AGA now has 6139 individual members, an all time high . . .

"Our relations with gasmen in foreign countries are important. Recently I talked with a number of them . . . There is much of interest and benefit to be gained by a study of gas operations in those countries. I sincerely believe a tour of the European gas industry by a representative team of United States gasmen is worthy of study in the near future . . ."

In regards to the PAR plan the "subscription quota for 1952 is $2,058,500 and up to Oct. 1, 1952, $1,977,493 has been received . . .

"I believe AGA research should be considerably expanded. This year the research program will cost some $700,000. This is only one-fifth of one percent of the gas industry net revenues for 1951 . . .

"One phase of our business, which is only beginning to get the attention that it deserves, is the industrial and commercial gas load, which accounts for nearly 40% of the total gas industry revenue . . .

"But there's a definite reaction today to the past curtailments of industrial gas. This is a situation that unfortunately cannot be corrected overnight. A committee is studying the problem. Sales of commercial cooking appliances have not been keeping pace with the increased sales and revenues of gas."

As for safety and accident prevention, "gas companies reporting to the National Safety Council indicate there has been a 12% reduction in the frequency of employee accidents for the first six months of 1952, as compared to the same period of 1951. This is good news, but the gas industry has not done as good a job in convincing the public of the safety aspects of gas service. Compare this with the railroads, which have convinced the American public that there's maximum safety in railroad travel."

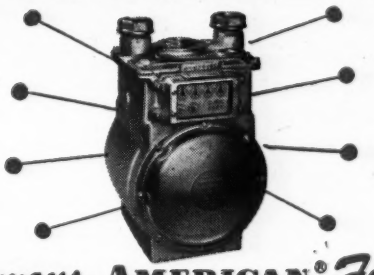
Sales

Expectations Realized Through Research

by F. A. Kaiser
Detroit-Michigan Stove Co.

"The requirements that should be met by a good deep fat fryer are: 1. Short warm-up time; 2. Quick recovery from the shock of placing cold foods in the grease; 3. Longer life of the grease used; 4. Ease of cleaning; 5. High quality of

AT LOWEST UNIT COST PER YEAR



Famous AMERICAN® *Firsts*

First with *adjustable tangent* permitting minor adjustments to be made with nuts and set screws.

First with the *two-piece valve box* cover and frame.

First with *cast-in valve seat assembly,* which automatically insures correct *crank bearing*—valve seat relationship.

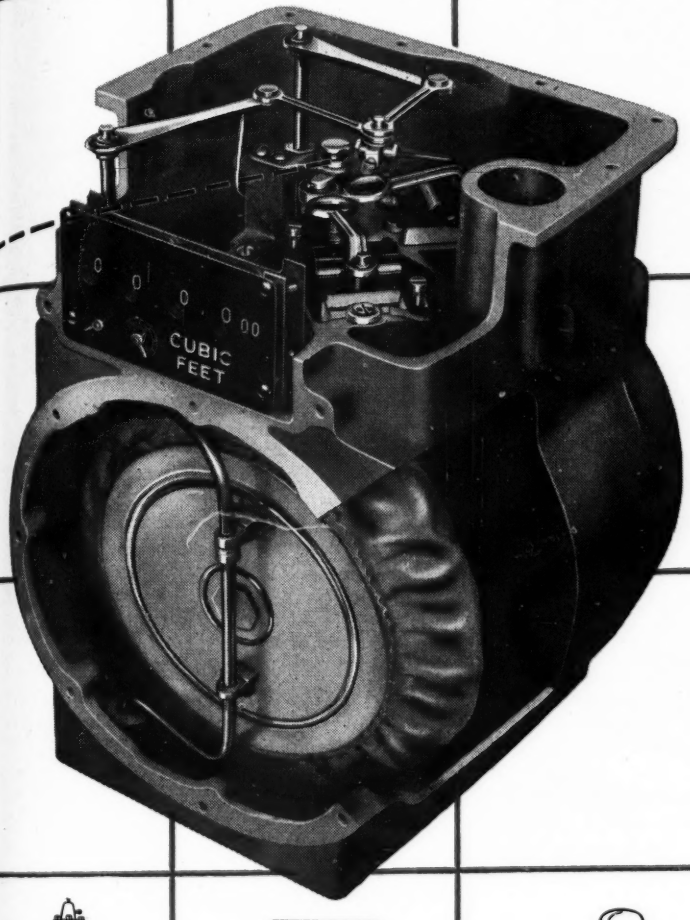
First with *Soldered Seal Index Box,* which has provided a permanently gas-tight index mounting.

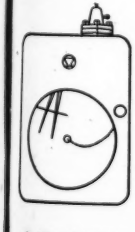
First with *smooth sliding bakelite valve covers* whose design practically eliminates valve noise in thousands of meters now in use.

First with *bakelite valve guides,* which have greatly improved silent guide wire action.

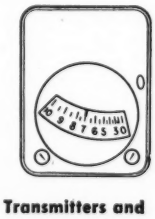
First with *increased capacity* without increasing the size of the case.

First with baffle flange screw, which has prevented meter tampering.

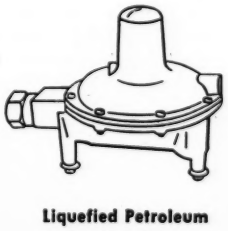




Orifice Meters



Transmitters and Controllers



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The efficiency and economy of *American* Meters is backed by more than 115 years of experience and by a constant purpose to provide the finest precision instruments known to gas measurement science.

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AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

food produced; 6. Capacity; 7. Sediment zone; 8. Sustaining of high production; 9. Low cost of operation; 10. Low cost of appliance.

"During the years manufacturers met many of these standards, but failed to meet all of them . . . AGA laboratories has made a study on development of deep fat fryers.*

"Up to the present time three manufacturers have submitted experimental fryers to the laboratories for tests. One of these has received approval on city gases only. One other has submitted his fryer and received approval on both city and L. P. gases. Three other manufacturers are remodeling or building new fryers."

*GAS, August 1952.

The Future of Clothes Dryer Sales Is Today

by Don Davidson
Whirlpool Corp.

"When you look at the national saturation of clothes dryers and see only 2.2%, you do not realize what a terrific sales volume has been reached in that figure.

"You have, in addition, heard predictions that by 1957 there would be 6.2 million clothes dryers sold. The grave error in this thinking is that it tends to make all of us think of the dryer as a sales product for 1957 or the future. That future is here today, however.

"We have today, in the U. S., 12 unusual dryer markets, representing a little over 42% of the potential dryer market. In those markets, automatic clothes dryers are selling at a ratio of 6 dryers to 10 automatic washers or better. In two markets they are selling at a ratio of 9 dryers to 10 automatic washers. We have one town of approximately 75,000 population where automatic clothes dryers are outselling washers by a ratio of 4 to 1.

"There are 26 different brand names of dryers on the market. Soon we will have 15 additional manufacturers. They are there for only one reason. Today, not in 1957, the sale of dryers is a very important profitable item.

"In 1949, the clothes dryer represented only 5.3% in dollar percentage of our [Whirlpool's] volume. In 1950, the dryer jumped to 10.1%; in 1951 to 20.6%, and this year to date, it represents 22.4% or almost one-quarter of our sales volume. Should plans go through as scheduled, and there is no reason to believe that they will not do so, the automatic clothes dryer in 1953 will represent 48.9% of our anticipated sales.

"Don't say you can get on the bandwagon later on, because the parade has already started. It is not necessarily a luxury market. Twenty-nine per cent of the dryers, according to a recent survey, were sold in homes valued between $10,000 and $15,000 and 17.1% in homes under $25,000 with the balance in higher priced houses.

"AGA very definitely and strongly recommends that in displaying the dryer, the counterpart, the matching automatic washer, be displayed.

"We made a survey to see how effective advertising was on twin units. We found that 84% of the women surveyed thought that you could only buy a matching washer and dryer in electric. They did not know it was possible to do so with a gas dryer. You cannot afford to send that prospective customer down the street to your competitor because you do not tell her that the matching unit is available in gas.

"By the end of the year there will be approximately 32 manufacturers in the business."

It takes a FULL team
. . . whether it's fire fighters
. . . or digging equipment
for big jobs
for medium jobs
Sherman for small jobs. The Sherman Power Digger is designed so that you get all the advantages of power digging on the smaller jobs where larger equipment is costly, time-consuming, and upsetting to work schedules. Thousands of users have proved that the Sherman Power Digger reduces costs. Write today for descriptive literature J3.
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an outside viewpoint can help your business

If your business is running smoothly, a periodic look at your operations through the eyes of EBASCO specialists can help keep it that way. Or, if you are confronted with a special business problem, EBASCO can assist you in arriving at a solution.

In many cases, EBASCO prepares special studies covering such business problems as organization and methods, sales and distribution, financing, tax, pension and insurance programs. Their clear-cut recommendations provide a blueprint for management action which the EBASCO organization is then prepared to help you put into effect.

Such activity is only part of the broad range of services performed by EBASCO, on a per-job or continuing basis, for business and industry all over the world. In addition, during its half century of experience, EBASCO has designed and built more than a billion dollars worth of new plants, assisted in solving production problems, developed industrial relations and safety programs.

When you call on EBASCO for assistance with special problems, you relieve your executives of an unwelcome and unwarranted burden—insure a quick efficient solution . . . one you can measure in dollars and cents of profit.

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The Commercial Cooking Business and the Gas Company

by Tracy B. Madole
Magic Chef Inc.

"The restaurant business is big business." It is the nation's third largest retail industry and its 235,000 restaurants and 569,000 food service establishments employ more people than any other retail business. Americans spend over $10 billion each year eating out.

"What's your commercial cooking business worth to your company? One of the best comparisons is with your heating load, which is big business. From a load standpoint, commercial cooking doesn't present big peak problems. There are no great demands for unusual service and collections are relatively good . . . It would be reasonable to suppose that rates should be correspondingly low, but that does not follow. Where I have investigated, commercial gas cooking rates are less attractive than heating rates. In fact, the average commercial cooking customer frequently pays substantially more for the gas he uses than the heating customers pay for an equal amount.

"Competitive commercial appliance sales have increased 60% in the last three years. This year over 25% of commercial appliances are going to competitors. Because of this:

"You need a commercial sales promotion program. You must provide for regular, effective sales contact with the user and keep adequate contact with architects and dietitians and with kitchen dealers and with their salesmen in your area. You must see to it that only AGA-approved appliances are sold on your lines and you must provide satisfactory service for commercial appliances in use in customers' kitchens.

"Less than one-half of the operators interviewed in an extensive survey had been consulted by the gas company on the purchase of new gas equipment or were informed as to new developments in equipment or cooking methods. There was a surprising number of dissatisfied users in spite of the popularity of the fuel.

"What are the manufacturers doing to help the utilities? First, top level manufacturers are providing gas appliances that will outsell and out perform competitive equipment in practically every respect. They are maintaining constant, effective, and costly national advertising programs and are providing promotional materials and adequate sales coverage."

Evaluation of Proof of Profits Campaign

by E. V. Fineran
Washington Gas Light Co.

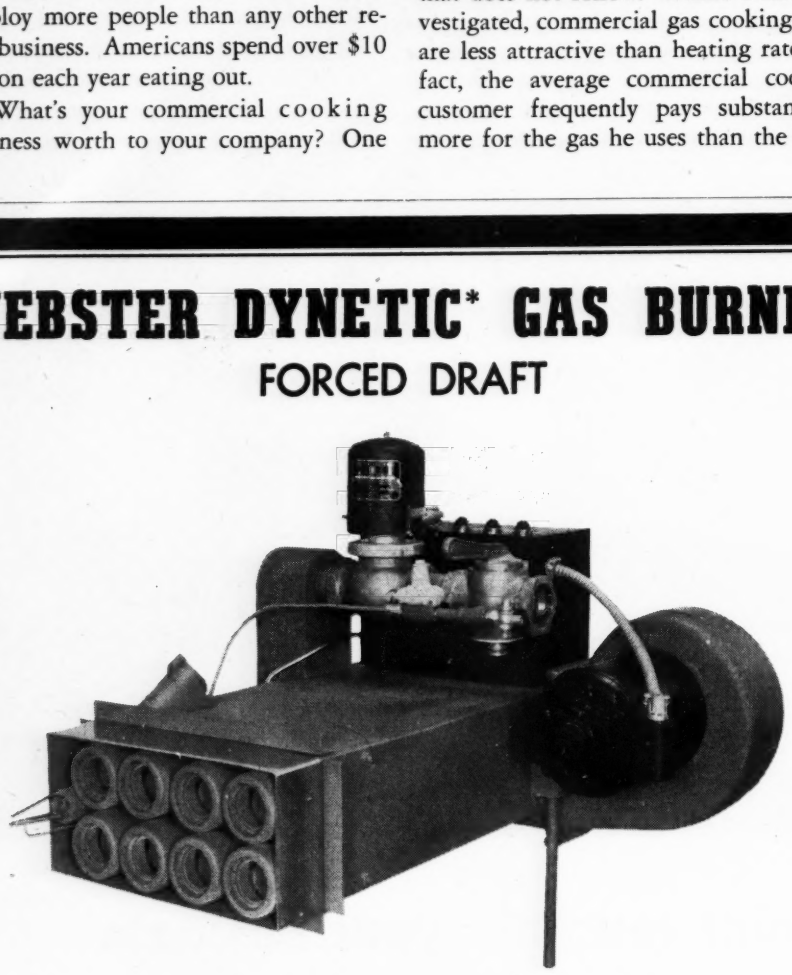
"The 1952 'Proof of Profits' sales campaign was a huge success—for a very small number of companies. The campaign, sponsored by the AGA as a promotional activity directed toward the commercial gas cooking appliance market and specifically directed toward the replacement of obsolete appliances and appliances using competitive fuel, provided the utilities with many promotional aids for a nation-wide coordinated effort of three months duration.

"Despite all these aids and the support of the association only six companies actively conducted a campaign, out of the 26 that had indicated their intention to participate, and of those six, only five submitted detailed reports of the results."

Summing up the five reports: Philadelphia Gas Works Co. replaced 165 electric commercial cooking appliances. The additional gas revenue will amount to approximately $12,000 per year. The company also made trial installations that

WEBSTER DYNETIC* GAS BURNER

FORCED DRAFT



The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

The burner is available in six sizes for natural gas.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

in almost every case resulted in a sale through a dealer.

Washington Gas Light Co. increased replacement sales 500%. While all commercial gas appliances sales were down 37% from the previous year, every one of the participating companies showed an increase.

A tabulation of the sales of the few reporting companies shows approximately 700 commercial gas cooking appliances sold with the replacement of more than 190 electrical appliances.

While not identified with the Proof of Profits campaign, the Oklahoma Natural Gas Co. showed a 370% increase in business during comparable period. From August 1950 to March 1951, 651 commercial appliances were sold valued at $150,460, but during the campaign from August 1951 through 1952, 3071 were sold with the total evaluation of $775,-791. The biggest jump was in water heaters where the comparative figures were 35 and 1183.

"Plans for the 1953 campaign are now under way. Seven top sales executives will form a committee for the purpose of securing the support for the campaign."

Operating

Report of Chemical Committee
E. G. Hammerschmidt, chairman

"The subcommittee on gas analysis and gas calorimetry was merged with two other subcommittees; gas analysis was merged with the subcommittee on analysis and tests, and gas calorimetry was merged with a new joint gas production and chemical subcommittee on instrumentation. Two other new subcommittees were authorized: natural gas problems and gas conditioning. This brings the total number of subcommittees to 12, three of which are joint subcommittees with the gas production committee.

"The participation of natural gas technologists in the joint production and chemical conference is of comparatively recent date and attendance of natural gas personnel has been rather small, possibly because the technology of the natural gas operator has been more fully covered in other organizations. When the newly created subcommittee on natural gas problems swings into operation, it is expected that natural gas operators will have a greater interest in the chemical committee than ever before."

Report of the Advisory Committee on the Gas Engineers' Handbook
F. E. Vandaveer, chairman

"Substantial progress has been made during the past year in revising the Gas Engineers' Handbook. As now planned there will be 17 major sections, each one with a number of subdivisions.

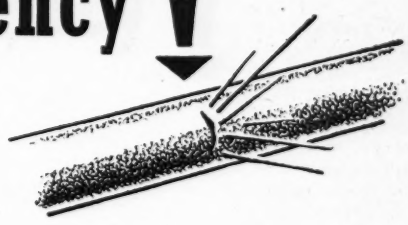
"C. George Segeler of the American Gas Assn. headquarters staff, with the approval of H. Carl Wolf, has agreed to undertake the editorial work on the handbook. The entire book is to be completely revised and brought up to date.

"The present book has eight major sections but the revised edition will have 17 major sections. Completely new sections include:

"Section 6—Production, Gathering, and Conditioning of Natural Gas; Section 7—Production and Handling of Liquefied Petroleum Gases; Section 8—Plant Instrumentation; Section 16—Chemicals from Gas; and Section 17—Purging.

"It is our hope that the completion date will be Feb. 15, 1954."

Emergency !



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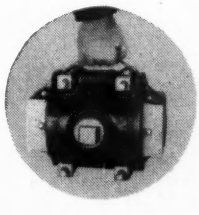
No emergency truck should be without the Dresser Style 80. Ideal as a tapping sleeve, also—sizes 3" to 8" pipe. Order today, or write for more information.



The Style 80 is packaged for convenience in storage and is easy to carry to the job

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Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto.

Report of Subcommittee on Meters and Metering

Gilbert Estill, chairman

"After considerable testing of various methods and conditions by F. C. Morey of the Bureau of Standards, a standard method for capacity testing of meters was developed and presented to the subcommittee on meters and metering."

Report of Subcommittee on Cast Iron Pipe Standards

Donald Whitcomb, chairman

"The present status of specifications under American Standards Assn. procedure that are being worked on is as follows:

"1. A21.1—Manual for computation of strength and thickness of cast iron pipe. At present undergoing revision to indicate data on pipe loads under embankments.

"2. A21.3—Pit cast pipe. A21.7—Centrifugally cast pipe in metal molds. A21.9—Centrifugally cast pipe in sand lined molds. A21.11—A mechanical joint for cast iron pressure pipe and fittings. All these approved by ASA committee A21 and most of the sponsoring bodies. Should be printed in a few months.

"3. Tentative standards on the application of rubber gaskets purchased for use in mechanical joint tests have been prepared.

"4. An additional mechanical joint standard has been considered by the committee entitled 'A Mechanical Joint with Lead Guard Ring for Cast Iron Pressure Pipe and Fittings' and referred to ASA A21 Technical Committee No. 4, whose responsibility is pipe joints, for further action."

Report of Customer Service Subcommittee

George B. Johnson, chairman

"Our subcommittee has worked toward the following four objectives:

"1. Development of a service training kit program. 2. Job procedures and policies on appliance servicing and connection work. 3. Appliance design and construction as it affects durability and serviceability. 4. Quality and uniformity of gas composition and pressure insofar as it affects servicing costs and customer acceptance.

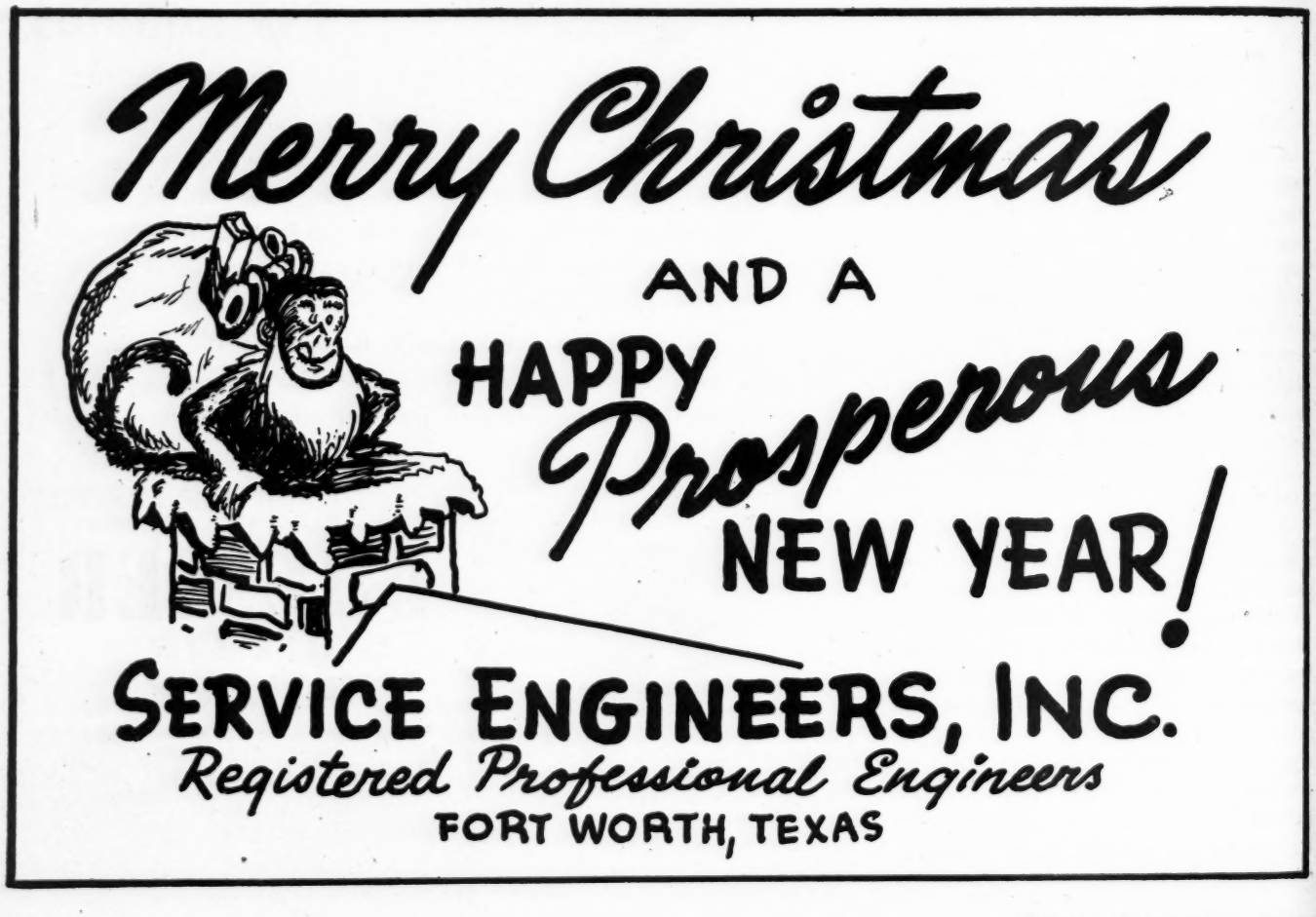
"At a meeting last February, two long-range objectives were adopted as follows:

"1. Development of a training manual entitled, "The Introduction and Operation of a Training Program.' This was to be developed in place of our 'Packaged Training' project. 2. Development of a 'Serviceman's Handbook.' W. C. Peters is surveying the industry in order to determine the value and feasibility of this project.

Report of Subcommittee on Distribution, Design, and Development

Karl E. Schmidt, chairman

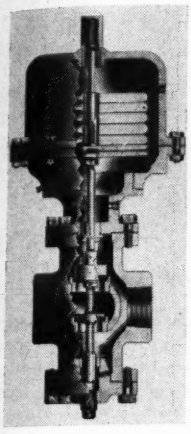
"The subcommittee decided that a recommendation should be made to the managing committee of the operating section to consider the possibility of establishing a means of arriving at some minimum requirements for the installation of pressure control in the relief devices in the gas distribution system. The operating section special committee on safety under chairmanship of H. Bruce Anderson is currently preparing a code for the design and construction of gas distribution systems, and the special committee on the operation and maintenance of a distribution system, under F. H. Bunnell, is actively preparing a code on the operation and maintenance of the gas distribution system."



New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

1 Pressure Regulator



The Climax Controls division of Black, Sivalls & Bryson has introduced a new back pressure regulator for distribution systems that relieves gas pressure to the atmosphere in the event of regulator reducing station failure. Designated Type 196, it is dead weight loaded and diaphragm actuated.

The soft neoprene construction of the discs on the inner valve insures positive shut-off. The same type regulator, slightly modified, can be used also for protecting compressor suction pressure on pipeline transmission systems. It is weatherproof and is available in various sizes since it is manufactured from standard control valve parts.
Black, Sivalls & Bryson Inc.

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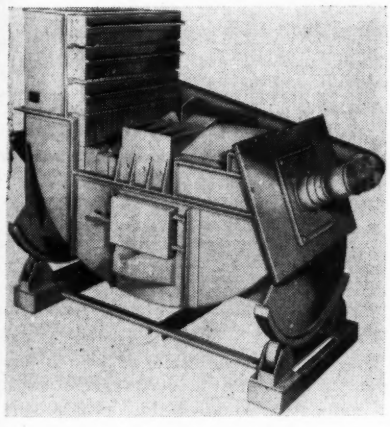

2 Reverberatory Furnace

Operating improvements for melting of ferrous and nonferrous metals have been provided in the newly developed Eclipse noncrucible, direct-fired reverberatory furnace. Its continuous-charge, continuous-pour operation insures high production of quality castings in less time and at less cost, with no time lost between pouring and recharging.

Hot metal is available—combustion normally wasted is used for melting or preheating cold metal in the hopper. The hopper, where the metal is charged, has a restricted opening at the bottom to prevent cold metal from contacting the molten metal and since the metal is melted quickly, there is little chance for it to absorb gases. Standard models of the furnace, equally efficient for large or small heats, have bath capacities ranging from 300 to 4400 lbs.
Eclipse Fuel Engineering Co.

■

3 Ground Anodes

A new line of graphite ground anodes for use in corrosion protection services has been announced by Cathodic Protection Service. The new anodes, made available through agreement with Great Lakes Carbon Corp., feature an unusually strong lead which is secured to the anode by means of a new method of attachment permitting exceptionally heavy loads on the lead itself. In the illustration, the lead is supporting the full weight of the two young ladies.
Cathodic Protection Service.

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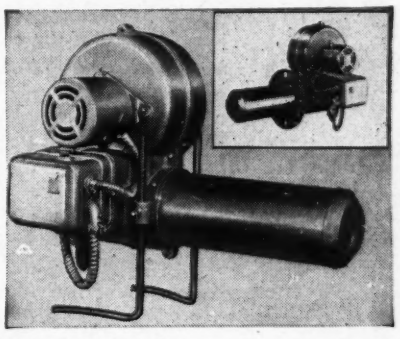

4 Gas Burner

A new Syncro-Flame power gas burner, designed to fit in the vestibules of most gas and oil burning furnaces, is entirely independent of chimney draft. Made by Synchronous Flame Inc., the burner is said to be the highest efficiency, swirling-flame gas burner available at the present. The mixing of air and gas results in rapid combustion with a short flame contained within the combustion chamber. The new burner rapidly attains incandescence and transfers radiant heat to the heating surface of the appliance.

Multiple air posts insure proper mixing of air and fuel and good flame retention. A mercury switch, actuated by fan air pressure, opens the main gas valve only when there is sufficient air for combustion. The pilot is ignited electrically by push-button control and both pilot and main valve have

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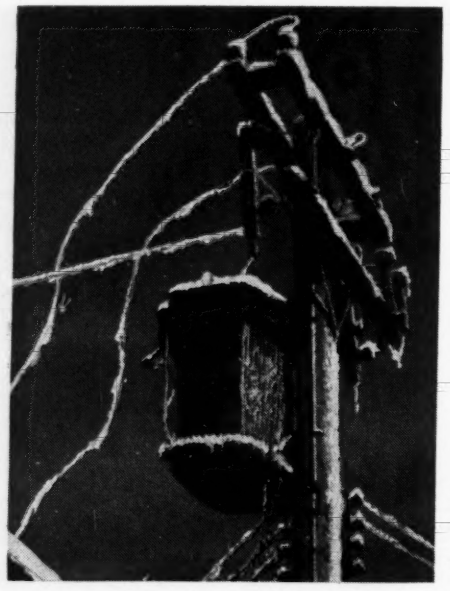

Heavy snow, ice and other severe weather conditions are often the cause of sudden power failures. Many hours are sometimes required to repair the damage to power lines.

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an automatic safety shut-off in case of flame failure. Three models are available from 75,000 to 500,000 Btu with either leg or flange mounting.

Synchronous Flame Inc.

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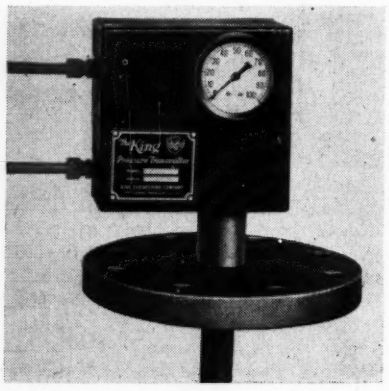

5 Pressure Transmitter

A pressure transmitter used with pneumatically operated instruments for measuring pressure of liquids and gases where a positive seal is needed between gauging system and the fluid measured has been announced by King Engineering Corp. In operation, the pressure of the fluid on the outer side of an exposed diaphragm is continuously and automatically balanced by the pressure of air supplied to the inner side. This air pressure is transmitted through a pipe or tube to the receiver.

Various types of receivers can be used: hydrostatic gauges, manometers, or pneumatically actuated recorders. Two or more receivers can be used with the same transmitter, at different locations if desired. Pressure ranges are from 0 to 45 psi.

King Engineering Corp.

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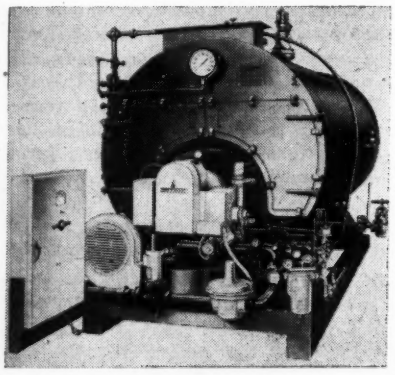

6 Boiler-Burner Unit

A completely new line of boiler-burner units with a wide range of commercial and industrial applications for heating, power, and process steam, has been announced jointly by Kewanee-Ross Corp. and Iron Fireman Manufacturing Co. Each unit consists of an Iron Fireman packaged burner complete with all controls and a Kewanee Scotch boiler, completely assembled with its accessory equipment for oil, oil and gas, or gas firing. They are designed for forced draft operation, eliminating the necessity of a high stack. Provision need only be made for a small vent extending above the roof.

The boiler-burner units are available for high pressure steam and water in sizes ranging from 52 to 304 hp, 136 and 150 lbs working pressure; for low pressure, 15 lbs steam or 30 lbs water, in sizes from 1,808,000 Btu to 8.4 million Btu.

Kewanee-Ross Corp. and Iron Fireman Manufacturing Co.

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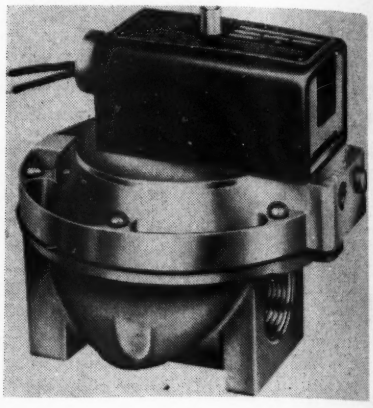


7 Diaphragm Gas Valve

A new diaphragm gas valve that is interchangeable with standard solenoids and operates on all gases has been introduced by Minneapolis-Honeywell. Cast aluminum body and housing, larger pilot passageways and a three-ply diaphragm using a nylon interior sandwiched between Buna-N rubber minimize servicing.

Model V499 is adapted for a.c. or d.c. line voltage; V899 is for low a.c. voltage. Five sizes are available, ranging from ¾ in. to 2 in., with a choice of manual opener, no manual opener, or manual opener with automatic recycling. The compactness of the control allows it to fit into smaller spaces than regular size valves, although it equals them in capacity and performance.

Minneapolis-Honeywell Regulator Co.

TRADE LITERATURE

8 Control Bulletin

A comprehensive technical paper on pneumatic final control elements has been published by Conoflow Corp. under the title of "New Techniques in Control Valve Design." Written by R. B. Werey, president of Conoflow, this well-illustrated bulletin covers in concise and readily understandable language a complete review of the development of present day conventional control valves and gives a preview of the designs of the future.

Conoflow Corp.

■

9 Radiography Booklet

A new booklet titled "Radiography for Modern Pipeline Weld Control" published by Elder & McNulty of Tulsa gives details on the process of using gamma-rays and X-rays for non-destructive inspection of pipeline construction where welding was done

under field conditions. The first part of the booklet gives the background of the process and its advantages, while the second part sets forth a detailed radiographic inspection code. This section is of particular interest because of the study now being made by the joint committees of the AGA and the American Petroleum Institute who are trying to set up standards for all radiographic weld inspections.

Elder & McNulty

■

10 Gas Combustion Story

The story of gas combustion and the growth of a large manufacturing organization built around its diversified applications is told in a new booklet entitled "Heat in Harness" produced by Surface Combustion Corp. Although designed primarily to tell the aircraft gas combustion industry about the technology and engineering that are embodied in today's aircraft heaters, the booklet covers the whole subject of how heat has been made useful to mankind.

Surface Combustion Corp.

■

11 Installation Manual

A 32-page "Installing and Servicing Manual" on gas and oil fired boiler-burner heaters and hot water heaters has been published by the Aldrich Co. for heating system dealers and their employees. Containing 44 illustrations, the new manual presents instructions in clear, simple detail. Specification charts on the various Aldrich household and heavy duty units are included, as well as a trouble-shooting section.

Aldrich Co.

■

12 Flow Meter Catalog

A new line of Honeywell evenly graduated flow meters is described in a 24-page catalog just released by the company. Complete specifications, operating information, accessory equipment data, and reference material on other types of flow meters are included.

Minneapolis-Honeywell Regulator Co.

■

13 Controller Catalog

A catalog, now ready for distribution by Fischer & Porter Co., describes a completely new P-4 Pneumatrol pneumatic controller for rate of flow, differential pressure, liquid level, viscosity, pressure and temperature applications. The action and components of the controller are described in detail.

Fischer & Porter Co.

■

14 Plastic Booklet

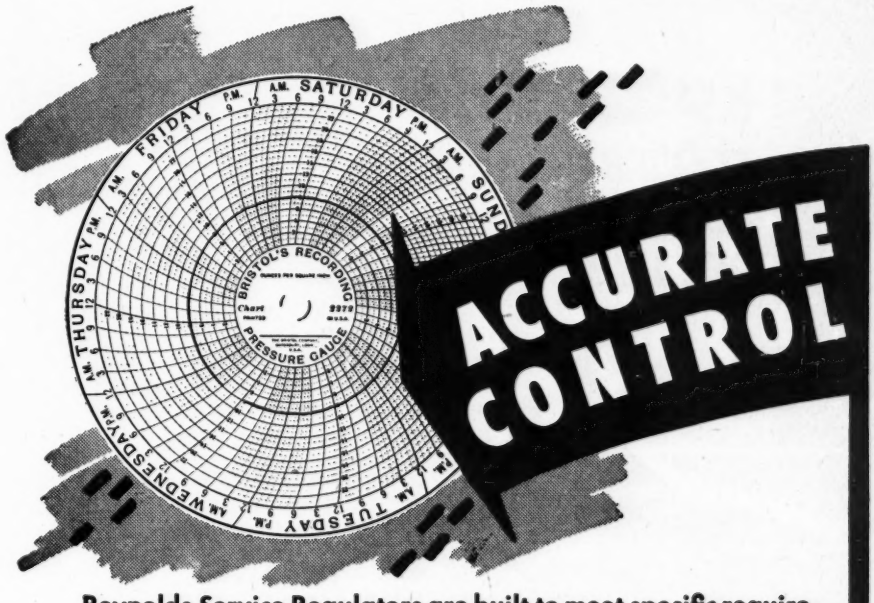
A booklet describing the New York Belting & Packing Co.'s "indestructible" plastic for use as pipe moldings, extrusions, or fabrications, has just been published. Toughness and high impact strength are achieved in products made of this plastic without sacrificing stiffness. It is noncontaminating, odorless, tasteless, shatterproof, and has excellent chemical resistance. Finished articles or components can be supplied.

New York Belting & Packing Co.

CURRENT READING

GAS FITTING AND WARM AIR, HEATING AND VENTILATING CODES — These Denver, Colo. codes have been prepared by the Rocky Mountain Gas Assn. and are available from that association at 327 C. A. Johnson Bldg., Denver 2. Chapter 51 (fitting installations) covers venting, burners and controls, and all gas piping. Chapter 52 (heating and ventilating) governs the construction, installation, alteration, maintenance and repair of all warm air furnaces; stokers; oil, solid fuel, gas, and L.P. gas-burning equipment utilized in domestic, commercial and industrial warm air heating and ventilating plants; and all cooking appliances.

IRON AND STEEL MELTING IN REVERBERATORY FURNACES AND OPEN HEARTHS—The second of three letters prepared by the 1952 metals committee of the AGA's industrial and commercial section covering the principal uses of gas for melting metals. Although only two makes of reverberatory furnaces are described, the results obtained can be duplicated by other types of furnaces. In addition, gas-fired open hearths, construction and maintenance costs, combustion, regenerators, fuel saving, and gas and oil firing are discussed. Information Letter No. 50.



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MODEL 20

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MODEL 30

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NEWS

Safety Code Completed By New York Commission

The New York Public Service commission last month finally finished work on its long-awaited safety code. All gas service companies in the state and all interstate transmission companies having pipelines in the state were ordered to undertake immediate programs for compliance.

The programs are expected to cost the service companies more than $6 million. There was no estimate of the amount that interstate companies will have to spend.

The order sets forth in great detail minimum safety standards for the operation of both local utilities and pipeline companies. The safety rules formulated for interstate lines go substantially beyond the requirements of the safety code of the American Standards Assn., which permits lighter cross-country piping than that required within cities and villages. The commission ruled that this was not satisfactory in New York since there are many populous areas that do not fall within the standard code classification of cities and villages.

The order, which grew directly out of the Brighton explosions last year and was later extended to cover operations of pipeline companies as well as utilities, directs every company transmitting gas at a pressure greater than 125 psi to conduct surveys within the next 60 days to ascertain whether their lines and facilities conform to the new standards. They have 90 days before they must submit a report to the commission.

Benjamin Feinberg, commission chairman, in announcing the code, rebuked "some" interstate pipeline companies for dealing "arbitrarily" with residents and for "causing damage to property." He recommended that a law be passed making such companies liable for triple damages.

Industrial Plants, Cities:

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Service Award To PG&E

The 1952 Building Industry Achievement Award that James B. Black (center), PG&E president, is receiving reads "in recognition of outstanding contribution to the industry and for service to the community." The award, presented in San Francisco recently, was given for PG&E's expansion program, one of the largest ever undertaken by any single utility company. The company's postwar construction expenditures will pass the $1 billion mark early in 1953. Presenting the award is Carl Gellert (left) of the Building Industry Conference Board. Looking on is Rear Admiral Lewis M. Moeller, director of the Pacific and Alaska divisions of the Navy's Bureau of Yards and Docks.

Gas Technology Institute Offers Home Study Course

The Institute of Gas Technology, Chicago, is extending its educational services to the gas industry by bringing instructions, through home study courses, to students and utility employees who are unable to attend classes at the Institute.

The courses are being prepared in cooperation with the AGA, which appointed a committee of utility executives to act in an advisory capacity.

The first course, "Natural Gas Production and Transmission," was authored by Joseph D. Parent, Dean of IGT. Subject matter is presented so that it can be understood by persons with little or no training in the fields under discussion and yet is sufficiently comprehensive to be integrated with cadet engineering programs. Also, it is designed to

serve as a refresher course for more experienced utility personnel.

Chemical, physical, engineering, and geological fundamentals are offered early in the course; then the student progresses in logical sequence through each phase of production, gas conditioning, and transmission. Economic and legal aspects of certain operations are discussed and the closing chapters contain information essential to an understanding of the business activities and problems of natural gas companies.

This first work, which became available in November, is printed in eight sections of two chapters each; a ninth section contains Chapter XVII and the index. The course is profusely illustrated with more than 170 photographs, drawings, flow diagrams, graphs and charts, most of them specially prepared for this work. Several plans of study are offered to fit individual enrollees, groups of students, and to fit into employee training programs. The fee for the natural gas production and transmission section of the course is $75. Libraries, schools, companies, and individuals wanting the text for reference purposes may purchase copies for $37.50 per copy.

Under the basic plan of the course, the student is supplied with the complete text upon enrollment. He is expected to study each chapter, consult a reasonable number of the references given, and submit a written report on each assignment. The reports, which may be submitted as rapidly as they can be properly prepared, will be graded by a member of the IGT teaching staff and returned with constructive criticism. The course can be completed in one year; it must be completed within two years of enrollment. Satisfactory completion of the course will be recognized by the awarding of a suitable certificate.

In the group plan, the group leader or company instructor assumes responsibility for all necessary guidance and supplementary instruction, including grading of papers and criticism and he will be supplied with the answers to the assigned problems in the course.

Two-Year Records Set By Heating Unit Shipments

With the shipments of gas-fired furnaces, boilers and conversion burners reaching their highest monthly total since the fall of 1950, GAMA announced that two-year records of all three types of gas-operated central heating equipment were set during the month of September. The association also reports a continuing upward trend in shipments of gas water heaters.

Conversion burners were up 65% over September 1951 and 35.1% over the third-quarter period of 1951; the total for the first nine months of this year rose to 153,200 units.

Gas-fired furnace shipments showed a 63.4% rise from 33,300 units in September of last year to 54,400 units this year, bringing the total for the nine-month period of 1952 to 314,200, a 10.1% gain over the same period last year.

With a 63.5% gain in the third quarter, shipments of gas-fired boilers jumped ahead of last year for the first time. The year's

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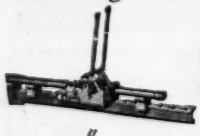

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total to date stands at 47,100 units, a 2.8% rise over the first nine months of 1951. September's shipments totaled 8500, a 63.5% gain over the 5200 units shipped in September 1951.

Shipments of water heaters, a 35.4% gain in September of this year, totaled 177,300 compared to 130,900. This brings the third-quarter aggregate to 476,000, a 33.2% gain over the 357,700 units shipped during the comparable period of 1951.

Standard Gas Dissolution Plan Gets Court Approval

The U. S. District Court in Wilmington, Del. on Nov. 7 approved the first step in the liquidation of Standard Gas & Electric Co., one of the last of the giant public-utility holding companies that are being liquidated under the public utility holding company act of 1935. According to E. O. Boshell, chairman of Standard Gas, the go-ahead on the dissolution plan for the company is expected to bring about final liquidation by mid-1953.

The company has been working on several dissolution plans since 1938 under orders from the SEC. At its peak, Standard Gas was a $650 million company with control of 150 utilities spread over 24 states.

New York Gas & Electric Celebrates 100th Birthday

The New York State Electric and Gas Corp., Ithaca, joined the select circle of century-old companies recently when it celebrated its centennial.

Approximately 3200 active and pensioned employees of the company joined in a state-wide celebration of the event with centennial birthday dinners being held in 15 communities throughout the company's service area. The dinners were highlighted by a graphic comparison of street lighting in the "good old days" with the modern street lighting equipment now in use.

The company's history dates back to Oct. 28, 1852, when the Ithaca Gas Light Co. was incorporated with a capital stock of $75,000 and became one of the leading concerns in the then small city of 7000 population. Today, the capital investment has been increased to more than $183 million and the area served has been extended to include 35% of the state.

September Sales Up 10%

Gas sales to ultimate customers during the month of September rose 10.0% over the same month last year, totaling 3464 million therms compared to 2946 million in September 1951, according to the AGA. During the 12-month period ending in September, utility sales rose to 50,417 million therms, a 7.9% increase over the 46,737 million sold in the comparable period a year earlier. Conversions to natural gas in upper New York state and the New York metropolitan and New England areas are responsible for the decline shown in utility sales of manufactured and mixed gas. For the 12-month period manufactured and mixed gas sales were 3334 million therms, a 2.6% decline from the 3422 million sold in the similar period last year.

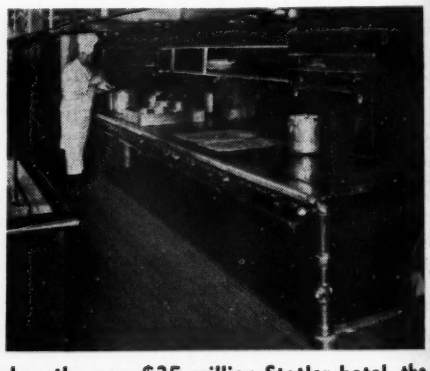
Promotion Group Named

Five new members have been appointed and 16 incumbents have been reappointed to the National Committee for L. P. Gas Promotion. New committee members are Harry J. Morley, FauceHot Heater Co., La-Porte, Ind.; Frank T. Carpenter, United Petroleum Gas Co., Minneapolis; Sam Coolik, Public Gas Co., Miami; Charles Grau, Oneida Gas Co., Rhinelander, Wis.; and K. R. D. Wolfe, Fisher Governor Co., Marshalltown, Iowa.

Co-sponsored by three trade organizations, GAMA, the LPGA, and NGAA, the promotion program is an industry-wide venture involving advertising, publicity and employee training. It is supported by voluntary contributions from producers and marketers of L.P. gas and manufacturers of LPG equipment and appliances.

Greenwich Gas Wins Award

The Greenwich (Conn.) Gas Co. has been awarded first prize in the nationwide, AGA-sponsored contest among gas utilities



Natural gas was very much in the spotlight when the new $25 million Statler hotel, the largest hotel built in the United States since the roaring twenties, opened in Los Angeles recently. The five modern kitchens, expected to serve more than 10,000 food orders daily, are equipped solely with gas appliances. Gas ranges, broilers, fryers, and bake ovens were selected by the hotel staff for "their speed, cleanliness, and ease of operation." Engineers of the Southern California Gas Co. were active in testing and advising on the operation and placement of the equipment. Every possible time and labor saving device has been incorporated in the layout and every operation is complete in itself.

John P. Crowley (right), Greenwich Gas, receives the congratulations of W. Paul Jones, Servel, for his company's prize-winning air-conditioning campaign.

for promoting all-year air conditioning.

The utility was honored for its promotional campaign built around the 66 new all-gas-operated homes in the Perryridge Knolls section of Greenwich. The homes feature Servel gas-operated year-round air conditioning and gas-operated appliances.

The award, consisting of a plaque and $500 in cash, was presented to John Crowley, sales manager of the company and director of the promotional work, by W. Paul Jones, president of Servel Inc., at the annual AGA convention in October.

New School Range Designed

The latest step in the Seattle (Wash.) Gas Co.'s educational program demonstrating the advantages of modern gas cooking is a deluxe new gas range designed especially for school home economic classes. Manufactured to Seattle Gas specifications by the Wedgewood division of Rheem Manufacturing Co., the new model is the first school or laboratory-size range to be made with all the deluxe, completely automatic features of the modern gas range. Called "Seattle Miss," the new range carries the gas sales story directly to potential homemakers and at the same time provides an excellent public relations tool for the company.

Newsnotes

A five-day short course in corrosion will be held Feb. 2-6, 1953, at the University of California, Berkeley, under the auspices of the university's extension department and the departments of mechanical engineering, mineral technology and chemical engineering in cooperation with the National Assn. of Corrosion Engineers. Speakers from industrial and governmental laboratories and academic institutions will cover basic corrosion science theory and application of corrosion mitigation measures.

Smaller manufacturers of tubular heat exchangers report that they are not inclined to expand their facilities through the grant of rapid tax amortization by the government unless they first can get some assurance of a minimum of orders during the next five years. During a meeting with officials of the National Production Authority, the industry's advisory committee reported that the industry at present is operating at only 80% of capacity owing to scarcities of controlled materials and to labor shortages.

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The Heiland G-2 Gas Leak Detector is widely known for its dependable, accurate and economical performance under all field conditions. Simplicity of operation and the ability to withstand rough handling by maintenance crews have made it a "workhorse" for utility companies, fire departments, manufacturers of paints and solvents, insurance companies and others whose activities bring them into contact with combustible gases. The G-2's reliability and sensitivity is well established by a record of the successful location of 95% of gas leaks within a minimum 2' x 4" street cut. It is lightweight and compact, detects low gas concentrations as well as locating larger leaks. The G-2 is adaptable to both "aspirator" and "open flow" tests... sample may be quickly aspirated. There are no restrictions in sample path... double filters prevent dirt and dust from getting into gas chamber. Three screens provide ample explosion check. The G-2 uses only standard flashlight batteries for power and has no separate gas meters, chambers or dilutors. All parts of instrument are easily accessible.

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CALENDAR

December

1-3....SGA, The Gas Company Advisory Council & Management Conference—Grand hotel, Pt. Clear, Ala.

5....NEGA Industrial Group of Industrial Division — Hampshire House, Boston.

11....NEGA Appliance Servicing Conference—Hotel Bradford, Boston.

January 1953

18-22....National Assn. of Home Builders of the U. S. — Conrad Hilton hotel, Chicago.

19-21....Pipe Line Contractors Assn. Annual Convention & Exhibition—Shamrock hotel, Houston.

20....NEGA Operating Division — Hotel Statler, Boston.

February

2-4....AGA Home Service Workshop —Baker hotel, Dallas.

18-19....PCGA Technical Services Conference — Hollywood, Calif.

25-26....PCGA Domestic Sales Conference — Los Angeles.

26....NEGA Accounting Division — Hotel Bradford, Boston.

March

16-20....National Association of Corrosion Engineers—Hotel Sherman, Chicago.

26-27....Oklahoma Utilities Assn. Annual Convention — Tulsa hotel, Tulsa.

26-27....New England Gas Assn.—Hotel Statler, Boston.

30-Apr. 1....Midwest Gas Assn. Annual Convention — Broadmoor hotel, Colorado Springs.

April

12-16....AGA Distribution, Motor Vehicles and Corrosion Conference—Hotel Sherman, Chicago.

13-15....AGA Sales Conference on Industrial and Commercial Gas — Hotel Warwick, Philadelphia.

13-15....AGA Accounting Section, Purchasing and Stores Conference—Shroeder hotel, Milwaukee.

13-15....AGA Sales Conference on Industrial and Commercial Gas—Hotel Warwick, Philadelphia.

16-18....Florida-Georgia Gas Assn.—Hotel Biltmore, Palm Beach, Fla.

20-22....National Conference of Electric & Gas Utility Accountants — Hotel Sherman, Chicago.

21-23....Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.

23-24....Indiana Gas Assn. Annual Convention — French Lick Springs hotel, French Lick, Ind. (Tentative).

27-29....Mid-West Regional Gas Sales Conference — Edgewater Beach hotel, Chicago.

29-May 1....Natural Gasoline Assn. of America Annual Convention—Rice hotel, Houston.

30-May 1....AGA Natural Gas Technical Conference — Edgewater Beach hotel, Chicago.

May

4-5....AGA Eastern Natural Gas Regional Gas Sales Conference — William Penn hotel, Pittsburgh.

4-6....LPGA Annual Convention — Conrad Hilton hotel, Chicago.

4-8....AGA Industrial Gas School—Sheraton-Cadillac hotel, Detroit.

Week of May 10....34th Annual National Restaurant Convention & Exposition—Navy Pier, Chicago.

11-13....Southern Gas Assn.—Jung Hotel, New Orleans.

11-15....34th Annual National Restaurant Convention & Exposition—Navy Pier, Chicago.

12-14....Pennsylvania Gas Assn. Convention.

20-22....GAMA Annual Meeting—The Greenbrier Hotel, White Sulphur Springs, W. Va.

24-27....AGA Production and Chemical Conference—Hotel New Yorker New York City.

28-29....Natural Gas & Petroleum Assn. of Canada — London, Ont., Canada.

June

14-18....Canadian Gas Assn.—Windsor Hotel, Montreal.

22-23....Michigan Gas Assn. — Grand hotel, Mackinac Island, Mich.

September

9-10....Pacific Coast Gas Assn. Annual Convention — San Francisco.

11....New Jersey Gas Assn. — Spring Lake, N. J.

October

26-29....AGA Annual Convention — Kiel Auditorium, St. Louis, Mo.

PEOPLE

FRANK E. HODGDON has been appointed assistant to the director of the AGA Laboratories, succeeding B. A. MCCANDLESS, who has been transferred to AGA headquarters. Mr. Hodgdon, with the laboratories since 1939 in various engineering capacities, will perform general administrative duties, have direct supervision over building and equipment, and act as personnel director. HOWARD W. SCOTT has succeeded Mr. Hodgdon as chief methods engineer.

As assistant managing director, Mr. McCandless will assist managing director H. Carl Wolf in the handling of executive detail for the association. He joined the AGA staff in 1939 in the appliance testing division.

B. A. McCandless

F. E. Hodgdon

The gas sales activities of the Public Service Co. of Northern Illinois, now officially located in Bellwood, Ill., have been placed under the general direction of Vice President E. E. LUNGREN. G. D. LYNCH has been appointed gas sales manager; F. C. UTTERBACK is manager, industrial sales; and L. C. HECHT is manager, gas sales promotion. Other personnel changes include the resignation of WILLIAM J. WHITE as treasurer and appointments of Vice President J. HARRIS WARD as treasurer, FRED N. BAXTER as secretary, O. C. SNYDER as assistant treasurer, and GEORGE W. RYERSON as assistant secretary. D. R. BOWER has been appointed assistant vice president, GEORGE C. LAUGHLIN has become superintendent of coordination station construction activities with N. D. BARNETT as assistant superintendent.

JAMES E. COLEMAN and GERALD E. WILSON have been elected assistant vice presidents in Columbia Gas System's Pittsburgh group, WAYNE L. HUTCHESON has been named purchasing agent, and ROBERT H. LOWE is now sales manager. Mr. Coleman will head a new department working on estimates of gas requirements and supplies. Mr. Wilson, in addition to his new duties, will continue as superintendent of distribution and will also head the sales department which has been made a part of the distribution department.

Rockwell Manufacturing Co., Pittsburgh, has named HOWARD J. EVANS to the post of chief engineer and ROBERT J. SARRAF as chief chemical engineer. In addition to

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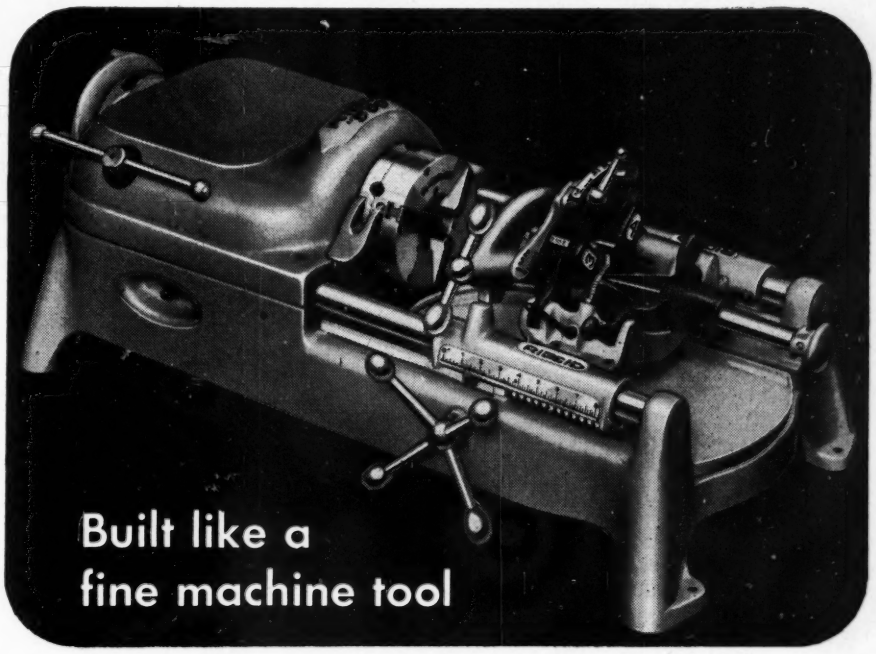

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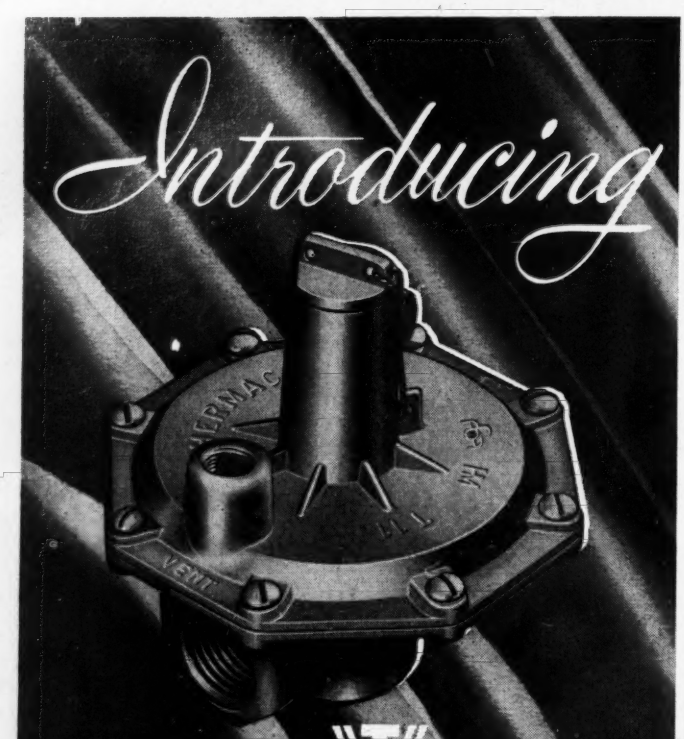

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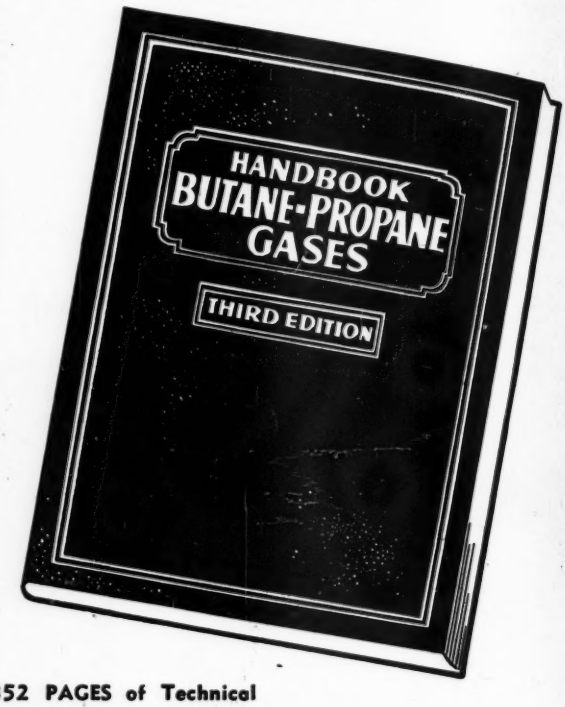

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Properties of Butane-Propane Mixtures
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Storage Tank and Pressure Vessel Design
Liquid Metering and Pumping Systems
Installing and Servicing LP-Gas Systems
Semi-Bulk Systems
Bottled Gas Systems
Gas Utility Service from Central Plants
Multiple Utility Service from a Central Plant
Comparative Performance with Other Fuels
Appliance Installation and Testing
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Commercial Applications
Industrial Applications
Enrichment, Peak Load and Standby Uses
Fuel for Internal Combustion Engines
N.B.F.U. Pamphlet No. 58 (1947)
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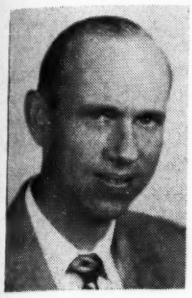
Los Angeles 4, Calif.

his new duties, Mr. Evans will continue as chief engineer for gas products and will be assisted by RICHARD F. MCCORMICK, chief products engineer for gasoline and oil products; BERNARD LAST, development engineer on lubricant accessories; and W. S. MCLAY, chief draftsman. In his new position as chief chemical engineer, Mr. Sarraf will be assisted by L. M. VAN DER PYL, chief chemist.

Another announcement from Rockwell is the appointment of WILLIAM M. CONNOR as general manager of the company's Macnick division. Mr. Connor, who will be located at the division's Tulsa headquarters, was recently factory manager in Pittsburgh.



Howard Evans

W. M. Connor

For his role in the reconstruction of Italian industry, THEODORE E. MUELLER, president of American Radiator & Standard Sanitary Corp., Pittsburgh, has been honored by the Italian government with the presentation of that country's Order of the Star of Solidarity. The presentation was made during a recent trip to Brescia, Italy, where Mr. Mueller officially opened a new pottery that American Standard has built there.

M. C. WHEYLAND has become general superintendent of transportation and buildings of Northern States Power Co., Minneapolis. He will be in charge of general office administration. A. H. HAMILTON, manager of gas operations, will devote his entire time to NSP's gas interests.

J. A. Bieber

J. A. Scanlon

JAMES A. SCANLON has been elected a member of the board of directors of the Ohio Fuel Gas Co. and JOHN A. BIEBER was selected as assistant vice president. Mr. Scanlon, vice president in charge of rates and regulations, has been with Ohio Fuel since 1925. He was elected treasurer in 1950 and vice president in February 1952. In his new position Mr. Bieber, since 1948 general sales manager in Columbus, will represent Ohio Fuel in contacts with wholesale and major industrial customers.

Succeeding Mr. Bieber as business promotion manager is J. G. BERWANGER. W. W. SELZER has succeeded Mr. Berwanger to the post of dealer promotion manager.

WALTER F. ROCKWELL, president, and GEORGE GUND have been re-elected as directors of the Timken-Detroit Axle Co. Other directors elected are WILLARD F. ROCKWELL, H. H. TIMKEN, R. J. GOLDIE, and W. ROBERT TIMKEN.

Two new regional sales managers have been named by General Controls Co., Glendale, Calif. B. L. LERCH, formerly Chicago factory branch office manager, has assumed his duties as regional manager for the Middle Western territory, supervising offices in Minneapolis, Milwaukee, St. Louis, Chicago, Indianapolis, and Des Moines. RUSSELL STRONGMAN will supervise activities in the eastern seaboard area covering factory branch offices in Newark, New York, Hartford, and Boston.

In addition, the company has appointed R. C. BOEHM to the post of assistant manager for both the appliance and heating division in the territory east of the Mississippi.

HOMER LAUGHLIN has become advertising manager of the newly created advertising department for Southern Counties Gas Co., Los Angeles. Heretofore advertising activ-

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DETROIT BRASS & MALLEABLE CO.
SPECIALTIES DIVISION
DETROIT 9, MICHIGAN

AT YOUR SERVICE IN THE NATIONAL EMERGENCY

ities of Southern Counties and Southern California Gas Co. have been under the joint leadership of J. S. SPAULDING, who will now devote his full time to SoCal advertising activities.

In line with plans for the creation of a new division with headquarters in Pasadena, Calif., the Southern California Gas Co., Los Angeles, has named MYRON G. THOMAS to head the division. Mr. Thomas' appointment became effective Nov. 1; the new office is expected to be in operation by the first of the year.

ELLSWORTH UNGETHUEM has been appointed general superintendent of plants by the Milwaukee (Wis.) Gas Light Co. The newly created position includes duties formerly allocated to the general superintendent of production. Mr. Ungethuem was formerly with Stone & Webster Service Corp., New York.

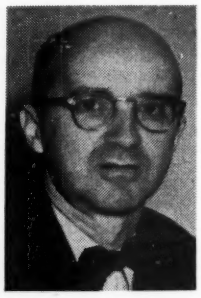
ROBERT P. LIVERSIDGE is now vice president in charge of operations for Philadelphia Electric Co. He joined Philadelphia Electric in 1932 and in 1949 was named assistant general superintendent of station operations. In 1950 he became assistant manager of electric operations, and in 1952, manager.

Hayes Manufacturing Co., Erie, Pa., has appointed DENZLE Q. WHITEHAIR as its representative in the territory comprising Alabama, Georgia, South Carolina, and Florida.

R. P. Liversidge
Philadelphia Electric

D. Q. Whitehair
Hayes Manufacturing

D. JOE HENDRICKSON was recently named distribution department superintendent at Citizens Gas & Coke Utility, Indianapolis. He has been with the utility since 1936 as an engineer. The company has also announced that CLARENCE J. TAYLOR has joined the Citizens Gas staff as dealer relations manager.



D. J. Hendrickson

C. J. Taylor

JOHN J. FENDYA, formerly general superintendent, has been named plant manager of the St. Louis division of Magic Chef Inc. . . . Recently elected directors of Republic Natural Gas Co., Dallas, include E. L. DEGOLYER, KARL HOBLITZELLE, T. A. KNIGHT, L. W. MACNAUGHTON, F. M. MAYER, W. J. MORRIS, R. J. PRYOR, and W. W. TURNER . . . GEORGE H. JENKINS, superintendent of the Gas Service Co.'s Bartlesville, Okla. division since 1939 and assistant to the manager for the past several years, has been named manager. He succeeds A. F. POTTER, who has resigned to become national accounts representative for Cities Service Oil Co., Bartlesville . . . MARQUIS A. KIRK is now administrative assistant to Chairman James F. Oates of Peoples Gas Light & Coke Co., Chicago.

Engineering department changes at Portland (Ore.) Gas & Coke Co. include J. K. LEHMAN, technical supervisor; H. O. ERVIN, research engineer; THOMAS HENSHAW, assistant to the chief engineer; and JAMES RATH, gas engineer . . . Bendix Home Appliance has named JOHN PAUL JONES director of engineering and DONALD M. STRATHEARN as his assistant. WALLACE F. OLIVER, former director, has moved to Florida and will serve as engineering consultant.

Magic Chef Inc., St. Louis, has announced the appointment of L . L. PETERS as general sales manager, gas ranges . . . THEODORE H. KENDALL has been named executive vice

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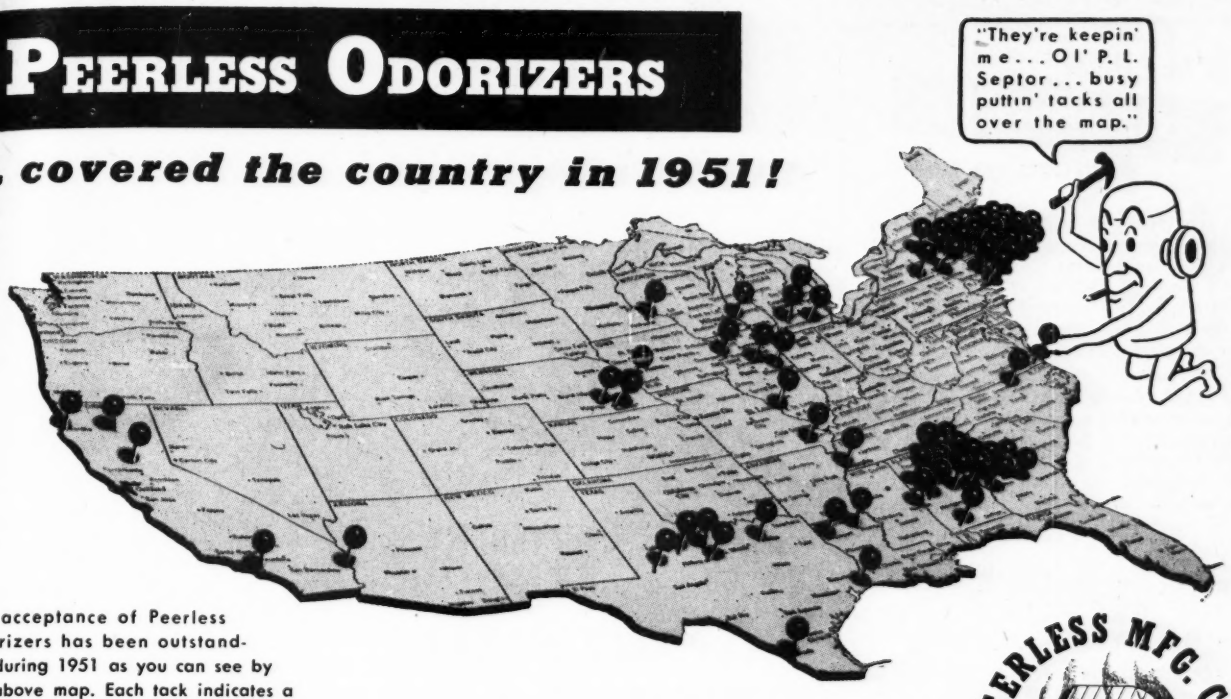

The acceptance of Peerless Odorizers has been outstanding during 1951 as you can see by the above map. Each tack indicates a Peerless Odorizer installation. Gas Companies are finding Peerless Odorizers accurate for metering odorant into natural gas lines. Operational costs are reduced to a minimum.

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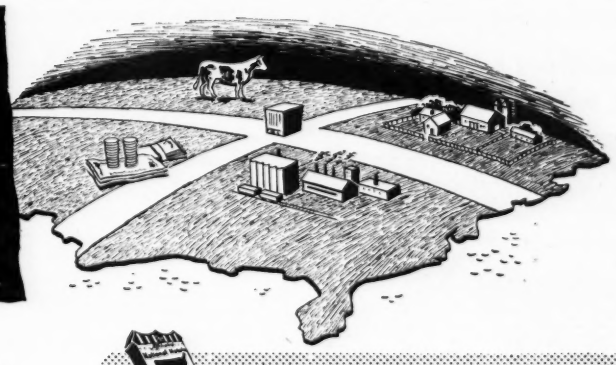

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HOTEL GALVEZ	Galveston
HOTEL JEAN LAFITTE	Galveston
CORONADO COURTS	Galveston
MIRAMAR COURT	Galveston
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HOTEL CACTUS	San Angelo
HOTEL MENGER	San Antonio
ANGELES COURTS	San Antonio
VIRGINIA	
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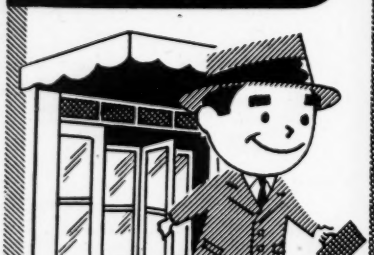

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president and a director of South Jersey Gas Co., Atlantic City. As a director, he succeeds MEREDITH L. ABBOTT, who resigned recently.

LOUIS G. RAICHE has been appointed works manager at the St. Charles, Mo. plant of the American Car & Foundry Co. . . . JOHN J. MOLLOY has been named public relations specialist for the New England Gas & Electric Assn. and its operating utilities.

Obituaries

SELAH S. TOMKINS, 57, chief chemical engineer of Consolidated Edison Co. of New York Inc., died late in October. Mr. Tomkins, who joined ConEd in 1917, became laboratory engineer in 1937, his title later being changed to chief chemical engineer in recognition of the responsibility of his position. He had long been prominent in gas utility association work. At the time of his death he was a member of the research committee of the AGA and a member of the American Standards Assn. He also had served as president of the Gas Engineering Society of New York and was a former director of the fuel section of the American Chemical Society.

FRED H. HAGGERSON, chairman of the board of Union Carbide & Carbon Corp., died in New York City on Oct. 14 after a short illness. He was 68 years old. Mr. Haggerson, who became chairman in 1951, had been with Union Carbide for over 33 years having served as vice president, a director, and president and a member of the executive committee. He promoted a policy of research and expansion that has been in a large measure responsible for the growth of the firm.

G. MAX THOMAS, 65, senior valuation engineer of Pacific Gas & Electric Co., San Francisco, died Oct. 17. A widely known engineer, Mr. Thomas was responsible for the valuation of PG&E properties in rate proceedings before the California Public Utilities Commission and for other purposes.

E. LEE JONES, associated with the Arkansas Natural Gas Companies, Shreveport, died in October. At the time of his death, Mr. Jones was chief civil engineer for the companies. He began his career with the firm in 1920.

RICHARD P. GONZALES, 57, of Shreveport, died last month in a Pine Bluff, Ark. hospital from injuries suffered in an automobile accident. He was assistant superintendent of the gas pipeline department of the Arkansas-Louisiana Gas Co., Shreveport.

LOUIS C. UPTON, chairman of the board and founder of the Whirlpool Corp., died Oct. 9 in Niles, Mich. Whirlpool's predecessor, the Upton Machine Co., was organized in 1912 by Mr. Upton.

JOHN R. PARRISH, manager of the Beverly Hills (Calif.) office of Southern California Gas Co., died in October while on a vacation trip in Illinois.

ASSOCIATIONS

Association Wins Award For Industry Service

One of the highest honors in the trade association field, the Award of Merit in the 1952 ATAE Awards, went to the Compressed Air & Gas Institute when it was cited by the American Trade Association Executives, the sponsoring group, for the valuable services it has rendered to its industry.

The institute, a trade association of manufacturers of industrial air and gas compressors and compressed-air-powered tools and rock drills, received the award "for its excellent services to its industry and especially for its education program centered on the schools of engineering throughout the United States and on the trade and technical press."

Many View Metals Show

Some 50,000 engineers among others viewed the AGA's combined industrial gas exhibit during the five-day National Metal Congress & Exposition held in Philadelphia recently. Ten cooperating exhibitors, manufacturers of industrial gas equipment, displayed their products under the blue flame banner in a 300-ft display space.

The gas display was the largest single exhibit at the show. The traditional highlight of the metal show, the annual industrial gas breakfast, was attended by well over a hundred industrial gasmen, manufacturers of industrial gas equipment, and representatives of publications in the metalworking field.

1953 IPE To Be Biggest

Additional space is being sought to take care of the unprecedented demand for exhibit facilities at the 1953 International Petroleum Exposition scheduled for May 14-23, 1953 in Tulsa. According to William B. Way, general manager of the IPE, requests and inquiries indicate that between 150 and 250 more oil equipment and service firms will contract for space than have exhibited at any previous exposition. There were 574 contracts for space at the last show in 1948, representing more than 1000 companies. More than 628 space contracts have already been signed for the 1953 show.

Home Service Group Meets

The coming year's activities of the 1953 home service committee of the AGA were outlined when the committee met recently in New York with Chairman Julia Hunter, home service director of the Lone Star Gas Co., Dallas, presiding. The agenda includes sponsorship of the annual home service workshop, to be held in Dallas Feb. 2-4; continuation of the third year of the broiler study and recommendations for a new broiler chart to be available in the fall of 1953; and the revision of four of the home service booklets.

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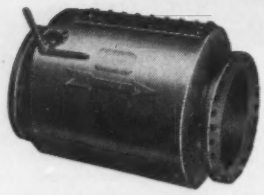

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ABSTRACTS

COMPARATIVE PERFORMANCES OF A WARM-AIR CEILING PANEL SYSTEM AND A CONVECTION SYSTEM—This bulletin presents the first results obtained in warm-air heating research residence No. 2, which was completely equipped specifically for research in warm-air heating by the National Warm Air Heating and Air Conditioning Assn. This residence, which was completed in June 1947, was a one-story structure of frame construction with a large amount of glass exposure and with a full basement.

The convection system referred to in the bulletin was a conventional forced warm-air heating system which included an extended-plenum trunk duct and high-sidewall registers. The results obtained with this convection system were compared with those of a warm-air ceiling panel system in which no heated air was introduced into the rooms. The panel system utilized the 8-in. deep air space provided by the open-web steel joists used in the ceiling. The lower panel surface, or ceiling of the first-story rooms, was constructed of pressed cement-asbestos millboard panels. The upper surface of the panel space consisted of ½-in. gypsum sheets, above which was placed a 3⅜-in. thickness of batt-type insulation in order to minimize the heat loss from the panel space to the attic. Relatively low airflow rates and low air velocities were utilized in the panel space.

The two systems were connected to the same furnace and were operated alternately throughout the heating season, so that the performance of each system was obtained over a wide range of weather conditions. The performance of the panel system is representative only of the warm-air ceiling panel installed and does not necessarily represent that which might be obtained with other heat transfer mediums or other locations of the panel. As far as air temperatures and average surface temperatures of the rooms were concerned, the performances of the panel system and the convection system were remarkably alike. Both the room-air temperature differentials in the living zone and the mean radiant temperatures were only slightly in favor of the panel system. The mean radiant temperature observed at the center of the living room by means of a thermo-integrator was only 0.5°F higher than the ambient air temperature for the panel system.

INTERCHANGEABILITY OF OIL GAS AND NATURAL GAS (IGT Interim Report)—This study presents an analysis of the combustion performance of oil gas and oil gas-natural gas mixture substituted for two natural gases at the adjustment manifold pressure on seven selected critical appliance burners adjusted to soft, medium and hard flame settings on each of the two natural gases. It also includes an analysis of the combustion performance of the two natural gases on these same seven critical burners adjusted on selected oil gases.

The gases tested were two natural gases, one a high-inert type and the other a high-methane type, and various oil gases, scrubbed and unscrubbed, of varying aromatic content

and heating value, diluted to a heating value of 1000-1050 Btu/scf with a synthetic blow-run gas (composed of 80% nitrogen and 20% carbon dioxide). Further to study the effects of dilution with inerts, oil gases of 1300 Btu/scf true oil gas heating value were tested at varying synthetic blow-run contents up to 30 volume per cent. The degrees of substitutability of the oil gases for the two natural gases, and of the natural gases for selected oil gases, are reported. The substitutability of the oil gases for each of the natural gases, after adjustment of the burners at rated input on the natural gases, is given in terms of the maximum per cent oil gas in the oil gas-base gas mixture which exhibited satisfactory combustion performance on those critical burners. Correlations are presented relating the substitutability of the oil gas with the true (diluent-free) oil gas heating value.

MANUAL FOR THE DESIGN OF BOX-PLENUM TYPE AIR CONDITIONING DUCT SYSTEMS—The high cost of conventional air duct systems for winter, summer, and all-year air conditioning installations in residences emphasizes the need for simple, inexpensive types of air duct systems having efficiencies equivalent to the types being widely used at present. One such simple and economical type is the *box-plenum* air distribution system, the design procedure for which is presented in this manual. The usual components of this system are:

1. A *trunk duct* leading from the conditioner to the box-plenum.
2. An air distributing compartment of simple, rectangular construction designated as a *box-plenum*.
3. Individual *branch ducts* leading from the box-plenum to the supply outlets located in the various rooms of the residence.

The cost of this type of supply duct system is generally less than that of a trunk duct system, because the plenum is of rectangular construction without transition sections and the branch ducts are butted to the box-plenum, thus eliminating intricate takeoff fittings.

The design procedure given in this manual applies to residential air conditioning systems for winter, summer, or all-year operation. This procedure may be used to design systems utilizing self-contained air conditioning units as well as systems which are built-up from various components selected and assembled by the contractor.

The material within this manual resulted from research on box-plenums conducted at the University of Illinois (AGA Project DGR-2-AC) as part of the PAR plan research program of the American Gas Assn. The technical results of this research program are available in recent publications.

The laboratory investigations conducted with box-plenums indicate that this type of air duct system will provide good performance if designed in accordance with the procedures set forth in the manual.

STUDY OF BURNER FLEXIBILITY ON BASE AND PEAK LOAD GASES—The purpose of this investigation, AGA Laboratories Research Report No. 1192, was to study burner design factors in order that maximum flexibility of performance on base and peak load gases without readjust-

JAEGER TRAVEL-AIR COMPRESSOR
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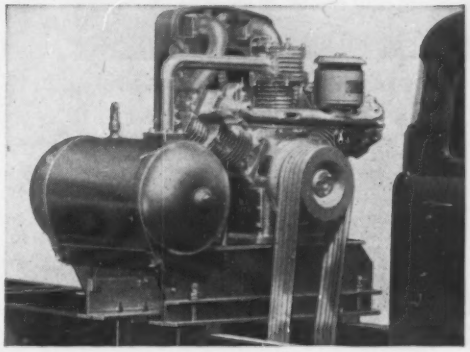
more air-125 cfm

no vibration

simple automatic engine speed control



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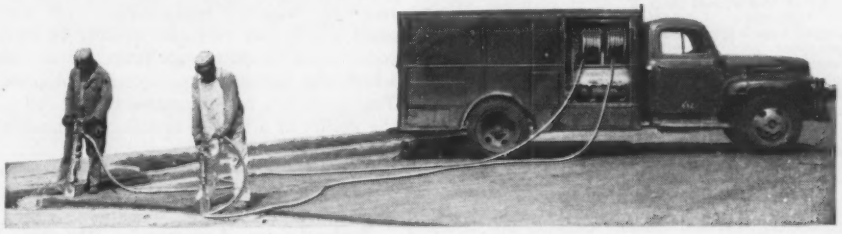

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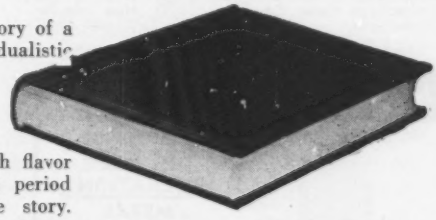

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ment might be provided. To achieve this purpose, factors influencing such performance flexibility were identified and evaluated.

The physical design of a burner provides a certain degree of potential flexibility. However, the actual flexibility obtained with a given combination of fuel gases depends to a great extent on the burner adjustment which includes both primary air adjustment and port loading. Because of differences in burner adjustment, one burner may have better performance characteristics than another, even though the second burner has a greater potential flexibility. Improper burner adjustment contributes at least as much to inflexible performance as the physical design of the burner.

The proper burner adjustment, as well as the degree of flexibility which can be obtained, depends on the nature of the fuel gases involved. Under extreme conditions, it would be possible to have gases which are in no way interchangeable, in which case burners would have no flexibility.

Because of an increasing use of supplemental or substitute gases to meet peak load or emergency conditions, gas appliance burners are often required to perform satisfactorily, without readjustment, on fuel gases which may vary considerably in their combustion characteristics from the gas on which the burners were initially adjusted. This flexibility of performance is related to the ability of a burner to minimize tendencies toward lifting flames, yellow tipped flames, or flashback. A criterion of burner flexibility, with respect to lifting and yellow tipping, is the span of possible primary air adjustments between the lifting and yellow tip limits.

In this respect, the following conclusions were made from the results of this study. At any given port loading, port size has no influence on flexibility. Increasing port depth will increase flexibility. Port spacing must be decreased to less than ⅛-in., edge to edge, before an effect is noted. Flexibility tends to increase considerably with very small spacings. Directing ports away from the vertical will decrease flexibility. However, with horizontal ports for example, this effect of port direction can be minimized somewhat by placing ledges just below the ports. With a given port spacing in the rows, a single row burner will have greater flexibility than double row burners having row spacing equal to or greater than (within reasonable limits) the port spacing. However, if row spacing is less than port spacing in the rows, it is possible in some instances for the flexibility of double row burners to be greater than that of single row burners. This condition requires very close row spacing. These same trends will in all probability apply to some extent to burners of more than two rows.

With a group of lifting and yellow tip limit curves established for any group of burners, the differences between the lifting limits and the differences between the yellow tip limits will be constant and independent of the fuel gas being burned. When fuel gas composition is varied, these limit curves will shift as a group so that the differences between them remain the same. Consequently, if the flame limits for any given burner are known for one gas, they can be approximated for other fuel gases for which flame limit data are available.

Flashback characteristics under equilibrium conditions of burner adjustment are controlled primarily by port size and depth, and they influence burner flexibility by limiting the minimum port loading which can be used at higher primary aerations. Of greater importance to flexibility is flashback under transient conditions, such as at extinction, which is controlled by the dimensions of the mixer tube as well as by port size. Flashback on extinction also limits the span of possible primary air adjustments with some types of gases since there is a limiting value of primary aeration above which this phenomenon occurs for a given port loading.

The appliance design introduces the effects of temperature and secondary air flow as well as the factor of completeness of combustion. However, it is doubtful whether these factors materially affect the relative potential flexibility inherent in a basic port design and port arrangement. However, improper matching of the burner and appliance design may prevent the realization of the inherent flexibility.

This research, conducted as a PAR plan activity at the American Gas Assn. Laboratories, was sponsored by the association's committee on domestic gas research under the designation of Project DGR-13-B, "Study of Design Factors to Provide Burner Flexibility Without Readjustment When Operated on Various Base and Peak Load Gases."

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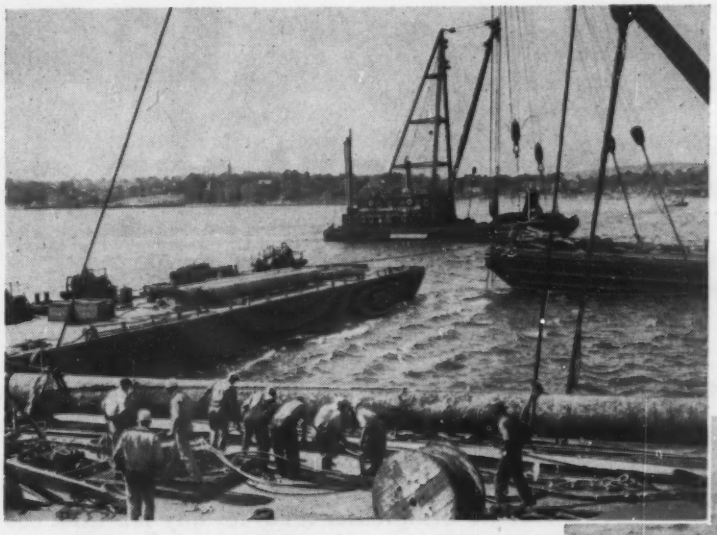
GAS PIPELINE NEWS AND FEATURES

Narrows Repairs Completed

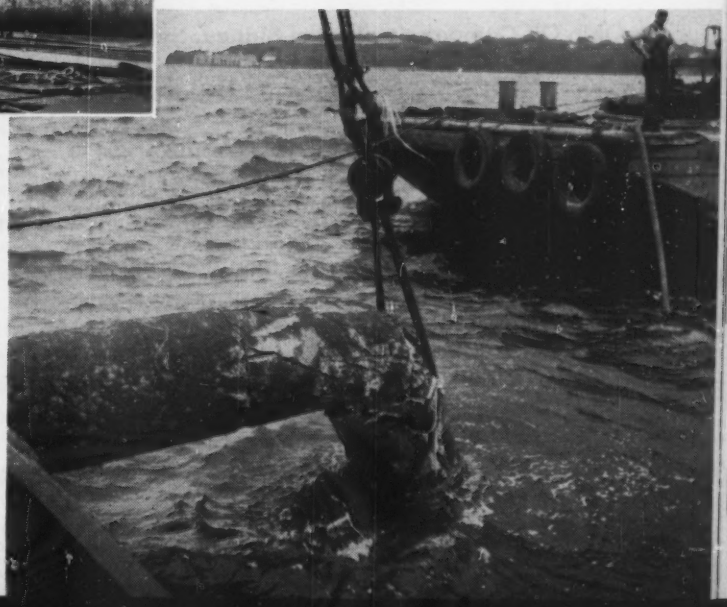
COMPLETION of repairs to a damaged section of the new gas pipeline across the Narrows of New York Harbor was announced recently by Transcontinental Gas Pipe Line Corp. The 24-in. pipe had been damaged by a ship's anchor on July 27 before gas had begun flowing through it to customers.

The repair job, which was handled by Merritt-Chapman & Scott, marine salvage engineers, fell into three phases. First, divers cut through the 6600-ft line and attached pontoons that were inflated to lighten the heavy load. Then four big derrick barges, braced against the tide, hauled up the severed ends and positioned them securely on a repair barge. There the damaged pipe was cut out and a new section welded into place, X-rayed and re-encased in protective concrete. Finally the newly joined line was carefully lowered back into its trench on the harbor bottom. Following checks by divers and further pressure tests, the line was reported satisfactory. The trench was backfilled with suitable soil to make further damage unlikely.

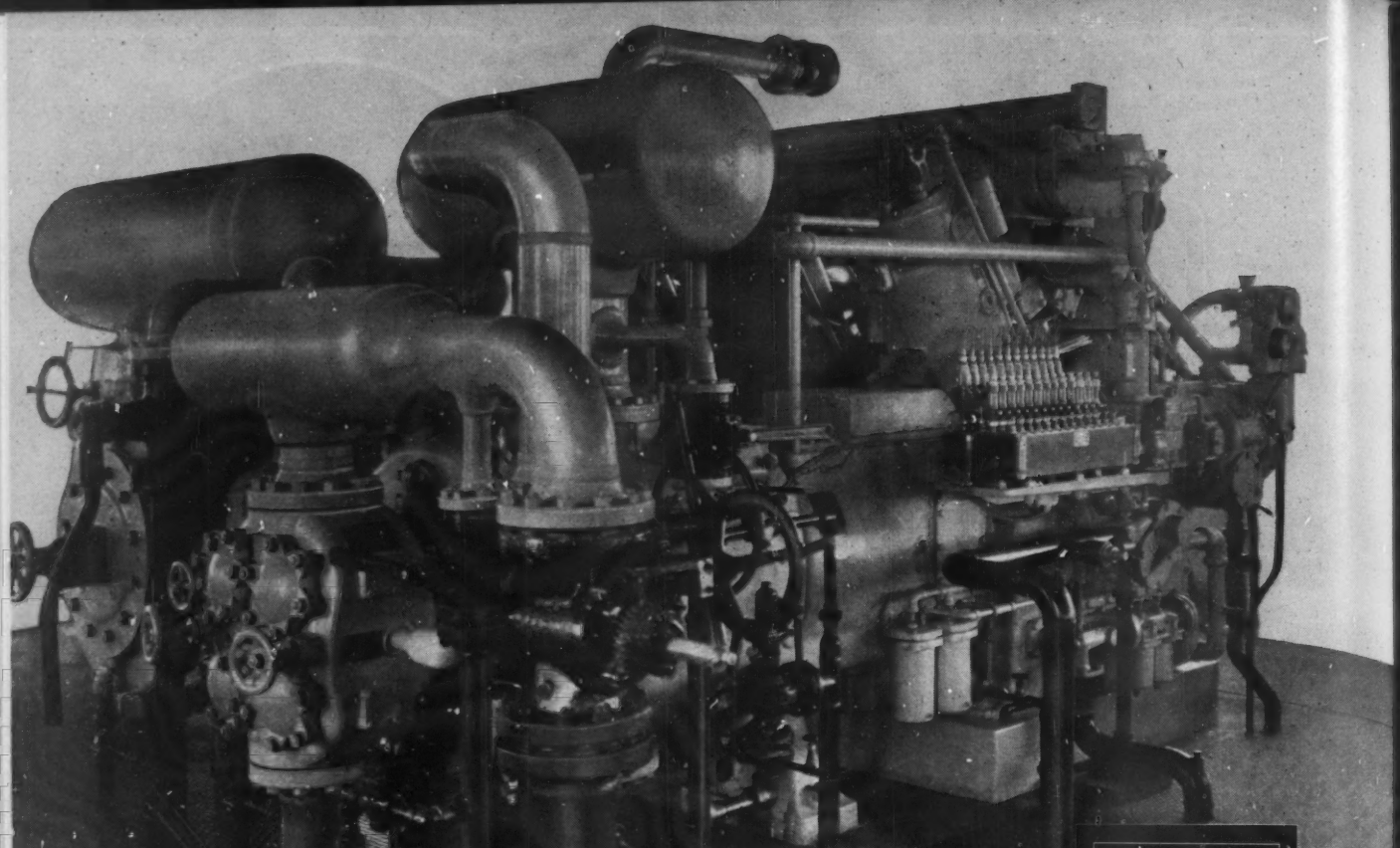
It is expected that commercial deliveries of natural gas will start flowing through the line before the end of this year upon completion of a metering station on Staten Island and the hook-up on the Brooklyn shore with the interconnected network of the metropolitan utilities.



Halfway across the Narrows, section of damaged pipeline rests on barge where repairs will be made.



Brooklyn half of damaged pipe is brought to the surface for repair. Line was cut in two by divers 85 ft under water.



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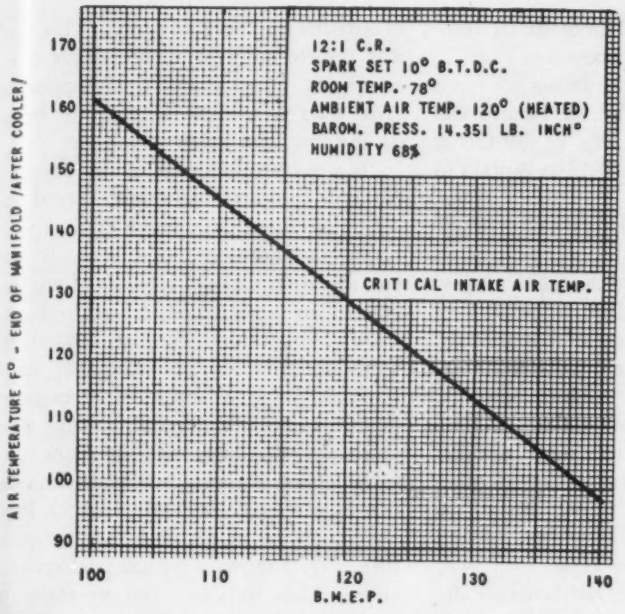


In modern high compression gas engines, temperature of intake air has a definite effect on knock performance. This graph (Fig. 1) illustrates this effect.

Intake Air Cooling Systems for Engines

By ROBERT C. COBLENTZ
Coblentz Equipment Co.
Erie, Pa.

This is the second of two articles on intake air cooling. The first article appeared last month.

OPERA singers have big chests. So do pearl divers. In every case where you need a lot of air, breathing capacity is increased. An engine breathes too. If you are going to burn more fuel to get more power, you need more air. It is impractical to expand the engine so you cool the air to get more into the cylinder.

This is where the intake air cooler comes in. When it can be applied, you get the desired temperature of the combustion air and use waste energy in the exhaust system for power. Net horsepower gains are greatly increased because less derating is required to limit detonation.

The following quote is from the December 1951 *Diesel Power & Diesel Transportation* and appeared in an article entitled "High Compression Spark Ignition Gas Engines" by George Steven of Worthington Corp.:

"Using 90° F ambient temperature as DEMA standard rating point, for every 10° higher ambient temperature, it was found that a reduction from 3½ to 5% in load was necessary to limit detonation, depending upon cylinder bore size. Larger bore cylinders are susceptible to somewhat higher deration than the smaller bore cylinders in view of the fact that the cooling jacket effect on larger bore cylinders is less than on smaller ones."

This serves to point up the fact that in modern high compression gas engines, temperature of the intake air has a definite effect on knock performance. The graph *(Fig. 1)* illustrates this effect.

High intake air temperature affects the engine rating in two ways. First, there is less air available to burn the fuel because the density and weight of air in the cylinder reduces with increasing temperature; and second, the average temperature during the combustion stroke increases about 2° for each 1° increase in the intake temperature. Thus less fuel can be burned and therefore less horsepower produced before the maximum safe heat load is reached.

The work of several investigators in the diesel field has amply demonstrated that the amount of power that can be taken from a given size of cylinder is limited, in general, by the maximum mean cycle temperature that can be tolerated by the materials of the parts involved. One means of increasing the power without exceeding the allowable temperatures is to reduce the temperature of the intake air at the start of compression.

The temperature of the intake air, for economy, should be as low as possible. This principle not only applies to air compressors and gas turbines but also internal combustion engines. The output of four-cycle both naturally aspirated and high pressure supercharged engines, as well as two-cycle engines, is limited by high intake air temperatures.

In *Fig. 2*, curves are plotted to show the exhaust temperatures at the cylinders and combustion air without intercooling (curve number 1), as they were recorded from an actual engine test. Curves numbers 2, 3, and 4 are the calculated exhaust temperatures that would exist at the cylinders if the intake air was intercooled to 60° F, 90° F, and 120° F, respectively. At 1000 hp engine load, 25 tons of refrigeration are required to cool the 9400 lb of air furnished by the blower at 208° F to 60° F (temperature difference between chilled water and air assumed to be equal to 15° F), and, as a result, would bring the exhaust temperature at cylinders down from 910° F to 775° F. On the basis of equal exhaust temperatures at cylinders, namely 775° F, these two curves indicate that the load

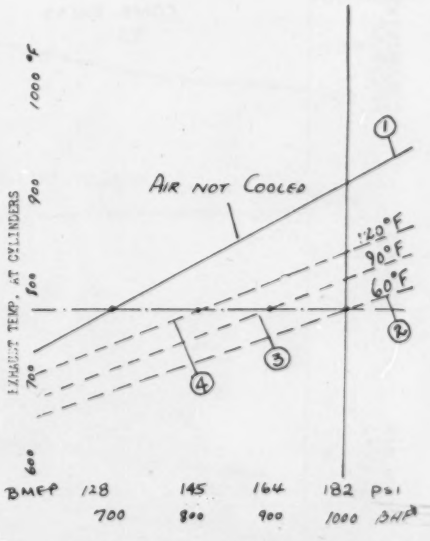


Fig. 2. Exhaust temperatures at cylinders when combustion air is not inter-cooled as recorded from an actual engine test.

This paper was presented before a meeting of the California Natural Gasoline Assn. in Los Angeles, Oct. 9-10.

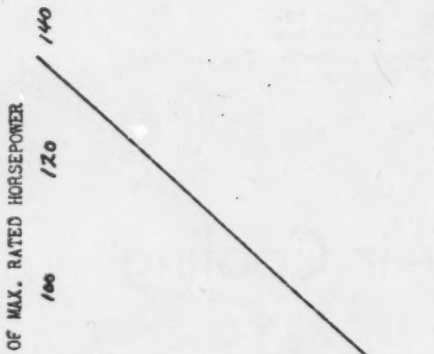


Fig. 3. Combustion characteristics of 8-cylinder supercharged engine operation with ambient air temperature of 110° F.

on an engine, by cooling its intake air to 60° F, can be increased from approximately 129 psi to 182 psi or 41% more horsepower.

One of the larger engine manufacturers has supplied us with combustion characteristics of 15½ by 22-in., 8-cylinder, 327 rpm, 4-cycle supercharged engine operation with ambient air temperature of 110° F as shown in *Fig. 3*.

We wish to quote the following from a paper presented by W. M. Kauffmann of the Worthington Corp. at the Oil & Gas Power Conference held in Buffalo in June.

"Development of the supercharge spark ignition gas engine was predicated upon experience acquired with supercharged dual fuel engines. It was found that while the injection of the metered gas into the intake air passage could be adopted in the new engine, optimum balance of combustion pressure and exhaust temperatures of the separate cylinders necessitated individual control of air flow. In this respect, similar design has been employed in the larger gas engines of the low compression type.

"Intercooling of the turbocharger discharge air by a heat exchanger located in the intake manifold served to raise the knock limited performance at the higher compression ratio of 12:1. *Fig. 4* illustrates borderline knock performance of this engine at fixed spark advance of 10° before top center. Manifold air temperature was increased by means of a heater as output was reduced, in order to maintain incipient knock at all loads. It is of particular interest that the exhaust temperature remained constant up to the maximum load in these tests. This load was limited only by turbocharger characteristics. Specific fuel consumption at rated load was 6320 Btu/bhp/hr based on the low heat value of the gas.

"It was observed early in the development of the dual fuel supercharged engine that these units were critical with respect to ambient conditions. It was also apparent that not all sizes of engines reacted, in the same degree, to high ambient temperature. Similar limitations were noted when operating on spark ignition. These became more pronounced as mean effective pressure ratings were increased. Research with the spark ignition version showed a straight line decrease in maximum load or knock limit with increase in manifold air temperature. *Fig. 5* shows a typical performance curve. This indicates the necessity of more drastic intercooling in order to maintain normal rated output at higher ambient temperature in excess of 90° F. Engine B curve represents the expected performance of smaller bore engines, which appear to be less sensitive to these phenomena. The fixed spark was maintained in order to reproduce economy and exhaust data.

"Where high pressure supercharging with blower air discharge temperatures above 200° F is utilized, it may be neces-

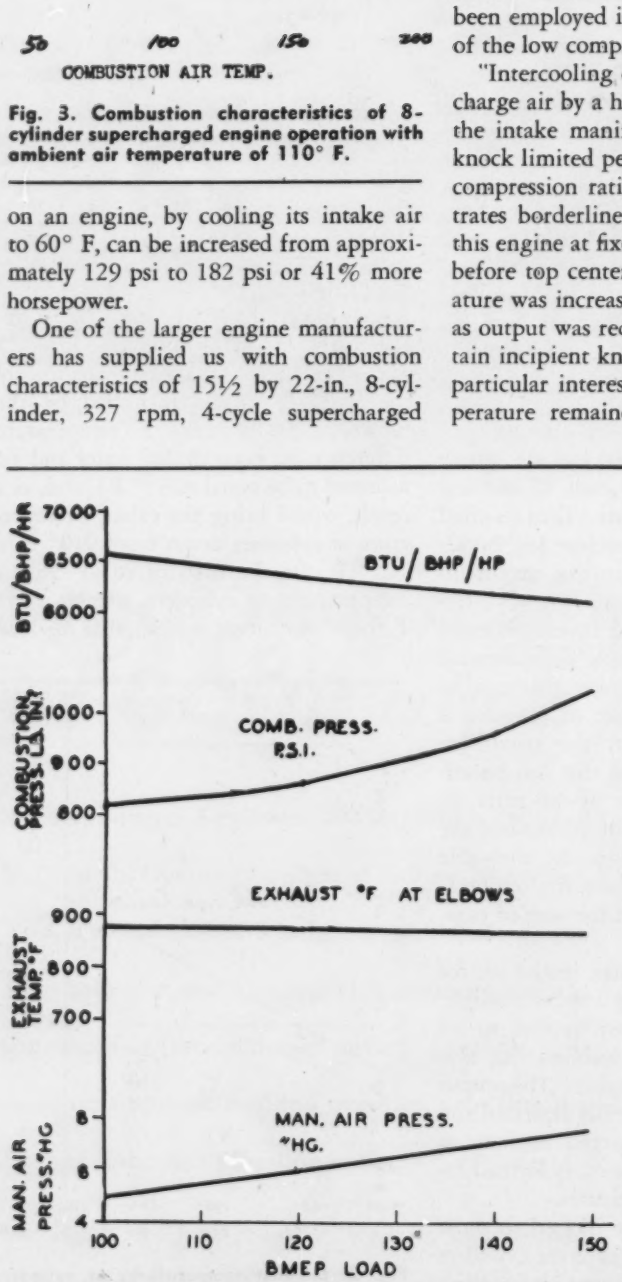


Fig. 4. Borderline knock performance of supercharged engine with 12:1 compression ratio at fixed spark advance of 10° BTC.

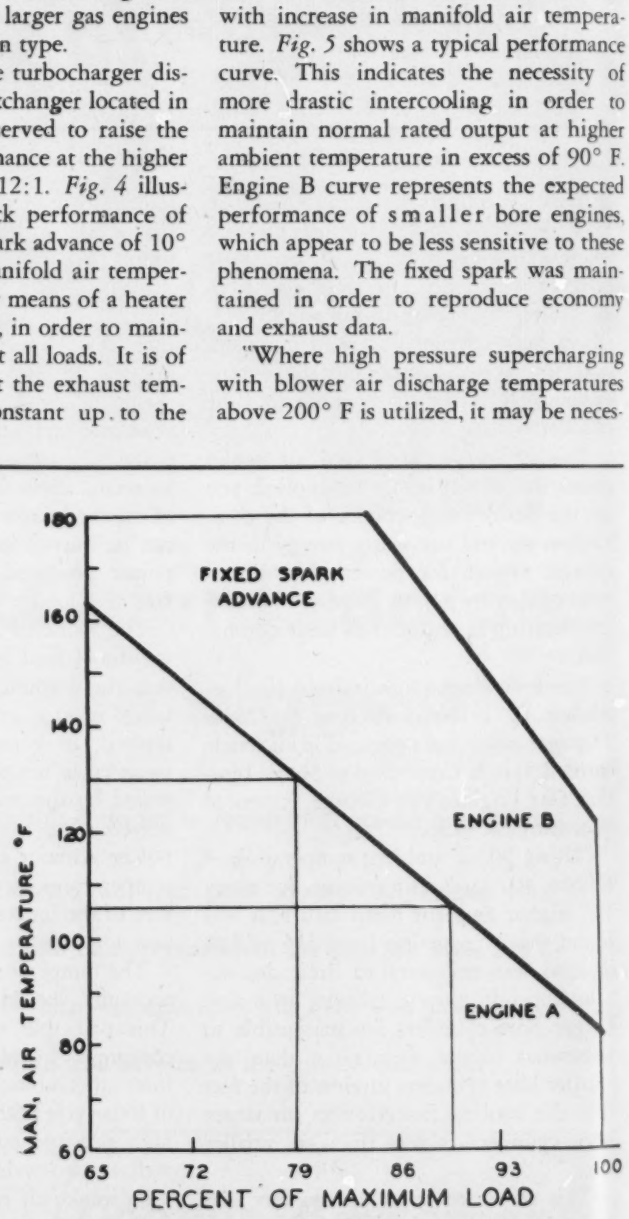


Fig. 5. Typical borderline knock performance curve indicating the need for more drastic intercooling to maintain normal rated output at ambient temperatures higher than 90° F. Engine B curve represents the expected performance of smaller bore engines, which appear to be less sensitive to these phenomena.

sary to resort to refrigeration of the cooling water to obtain adequate intercooling. Thus for high output, in excess of 150 BMEP, an absorption type refrigeration unit operating from exhaust waste heat may serve this purpose, particularly where water below 90° F is not available."

In our research to find the best method of producing an economical and reliable source of chilled water, the work has been a most interesting experience. The refrigeration industry normally uses such standard refrigerants as ammonia, freon, etc. that require compression equipment with a motor or turbine drive. This type of system was first tried in October 1948. While these tests proved successful for cooling the intake air, the operating cost of the motor plus possible service problems did not appear to be the answer. Further investigation in this field pointed to manufacturers of absorption refrigeration equipment. At that time these manufacturers knew very little about the advantage of cooling the intake air. Since then, however, research has proven the advantages to be gained by intake air cooling.

In producing refrigeration by the absorption principle (the underlying principles were recognized in the 18th century), heat is utilized as the motivating force. Generally, when an absorption cycle is mentioned, one thinks of an ammonia-water system, but there are numerous others that for their particular applications are just as practical.

The water-lithium bromide system in which water is the refrigerant and an aqueous solution of lithium bromide is the absorbent has been used in this design and been found very satisfactory *(Fig. 6)*.

Refrigeration tonnage delivered is in the form of chilled water that is easily piped to both the pre-cooler and intercooler for cooling effect. Simplicity of operation and control are the fundamental features inherent in this type of system. There are no moving parts within the absorption refrigeration unit; therefore, long life is assured with uniformly high efficiency at all times.

Fig. 7 illustrates the model IAC-25 unit. We believe this is a picture of the first packaged unit to be designed and built which converts waste heat into chilled water.

Although there is a constant source of heat from the engine exhaust, the temperature of these gases varies from 400° F to 1000° F, depending upon the load on the engine. Also, as the wet bulb temperature changes the condensing water temperature varies from 65° F to 90° F. The volume of steam required for the refrigeration system varies as the cooling load changes yet for a good operation the steam pressure delivered to the refrigeration system should be constant. One of the important features of the packaged IAC unit is that it automatically delivers the exact volume of steam at constant pressure. To the best of our knowledge, this had never been accomplished before where waste heat was converted into chilled water.

The amount of refrigeration that can be produced varies greatly with the temperature of the condensing water. For example, when producing 42° F chilled water this unit has a rating of 26.6 tons with 75° F condensing water and 13 tons with 90° F condensing water, a considerable difference in capacity.

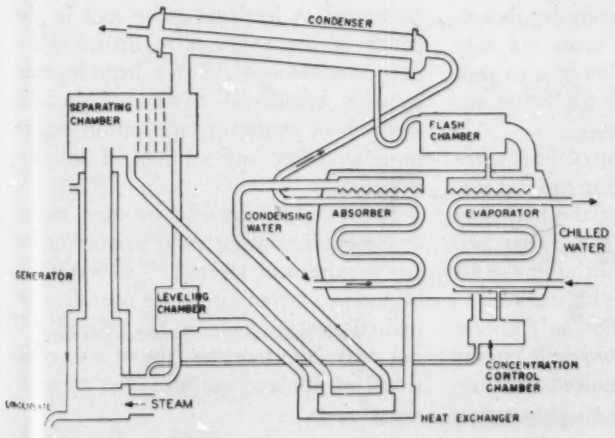
Condensing water may be a problem in some parts of our country. The cooling tower is the best answer so far. When a cooling tower is selected for this equipment, the amount of condensing water is 3.60 gpm per ton of refrigeration using 85° F cold water with an 18° F cooling range. For example, with 85° F water 72.6 gpm is required with 415 lbs of low pressure steam to produce 25 tons of refrigeration or 300,000 Btu/hr cooling.

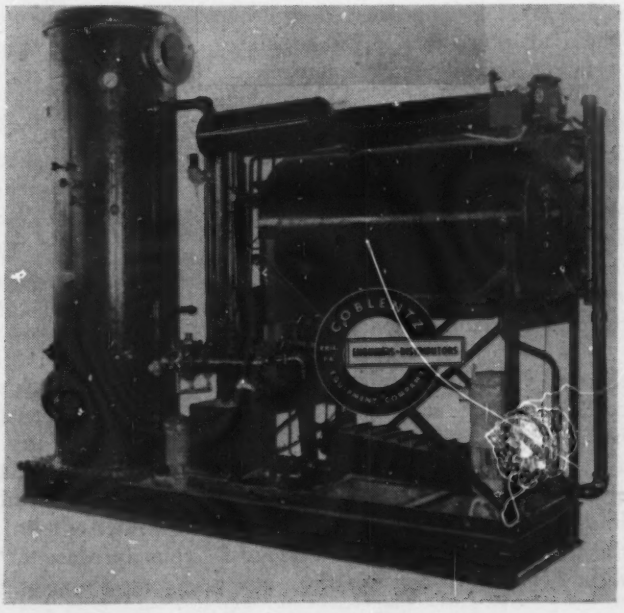
The steam system is complete with accessories and condensate return unit. Not all of the steam produced by the boiler is required for the refrigeration load; therefore, low pressure steam is available for process work, steam heating, or the heating of water. Alternately, a larger cooling unit would produce additional refrigeration.

A 4-cycle, 350 hp engine operating at full load wastes enough heat through the exhaust gases to deliver ample heat units to operate a 25-ton absorption refrigeration unit. Therefore, packaged units are assembled in different sizes. These sizes range from a unit for a 350-hp engine with a 25-ton water chiller to a 3500-hp engine with a maximum of 250 tons of cooling. Larger units with variable refrigeration requirements can be assembled to meet specific requirements.

The development of the packaged IAC unit makes a complete engine economizer system which automatically precools, inter-cools and after-cools the supercharged 4-cycle, gas and oil engine. The after-cooler (waste heat boiler) removes from the exhaust gases the neces-

Fig. 6. Schematic flow diagram of the water-lithium bromide refrigeration unit. Water is the refrigerant and an aqueous solution of lithium bromide is the absorbent. Fig. 7 (at right) shows the model IAC 25, believed to be first packaged unit to convert waste heat into chilled water.





sary heat units to operate the refrigeration system that, in turn, chills the water to pre-cool and inter-cool the combustion air.

Limitations have been imposed on inter-cooling owing to the relatively low differential temperatures between the combustion air and readily available coolants. The use of chilled water as a coolant provides a broader temperature spread and not only increases the temperature reduction in the inter-cooler, but makes pre-cooling practical.

Pre-cooling of the intake air provides a denser supply to the blower and thus improves its efficiency as shown in *Fig. 8*. This factor, plus the cooling effect, will permit supercharging at higher pressures without exceeding allowable cylinder temperatures.

Incidentally, the principle of improving blower efficiency also applies to compressor installations. Higher cfm outputs are possible without increase in unit size or drive horsepower.

Getting back to engines the following advantages are the important factors for using chilled water in a pre-cooling coil:

1. Closed chilled water circuit.
2. Dry coil — No carry over as from evaporative type pre-coolers.
3. Removes excess moisture that is easily drained away.
4. Lower horsepower required to operate the supercharger.
5. Lower leaving air temperature from the supercharger.
6. Smaller size inter-cooler (45°F chilled water as compared to 90°F cooling tower water).

Fig. 9 shows the combustion characteristics of an atmospheric 13 by 16-in., 8-cylinder, 450 rpm, 4-cycle engine with an ambient air temperature of 110° F.

From the analysis on the atmospheric engine a 50° F temperature drop in the intake air would enable the engine to operate at capacity even though the installation were made at a high altitude and with high ambient air conditions. Only pre-cooling would be required in this type of engine. Therefore, additional refrigeration capacity produced from the heat in the exhaust system could be used for other applications where chilled water or air conditioning would benefit the over-all plant efficiency.

In some designs of two-cycle engines there is very little room for an inter-cooler to cool the scavenging air after it has been compressed. When the ambient air temperature is 110° F there will be approximately a 50° F temperature rise in the scavenging air compressor so that the air will enter the engine at approximately 160° F. When this air is cooled

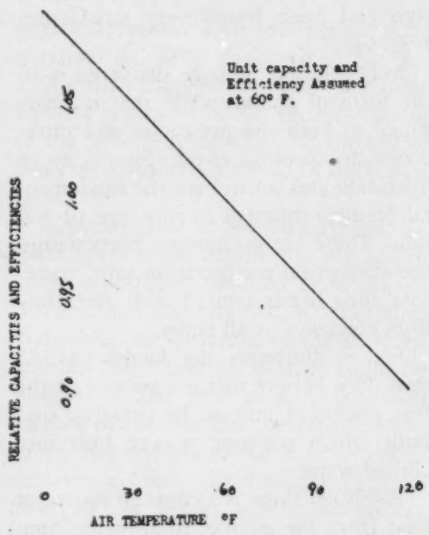


Fig. 8. Pre-cooling of the intake air provides a denser supply to the blower and thus improves its efficiency.

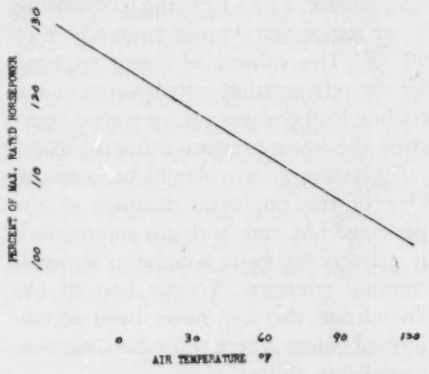


Fig. 9. Combustion characteristics of an atmospheric, 8-cylinder engine with ambient air temperature of 110° F.

to 60° F both before and after the blower, there will be a considerable improvement in the engine operation. In fact, the engine would operate at peak performance for the entire year instead of for several months during the winter. This, of course, will save considerable fuel each year.

Some recent two-cycle engine installations are supplied with combustion air from either engine-driven or motor-driven blowers. In these cases, the only reason for the external blower is to provide more scavenging air for better engine operation.

There is a vast amount of heat completely wasted in the engine exhaust system. The development of the packaged IAC unit to convert this waste heat into chilled water that can cool the intake air both before and after the blower to 60° F makes it possible to not only obtain the rated output for the two-cycle engine but to reduce the fuel required. Because of the rising cost of fuel, the utilization of energy in the most economical way possible is a problem concerning all plant operators. It is the purpose of this paper to indicate the trend toward higher efficiency, brought about by lowering the intake air temperature as much as possible. As I said before, there is a straight line decrease in maximum horsepower output with increase in manifold air temperature.

In the southwestern part of our country where the climate is hot and dry, the evaporative type pre-coolers do only a partial job of cooling the intake air. The IAC system produces refrigeration with practically no operating cost and, with the lower temperature of air, will greatly improve the efficiency in the mechanical operation with, of course, resultant savings.

For example, from the information we have from one engine manufacturer, their 2000-hp, 2-cycle engine has a rate of air flow of 10,000 cu ft of free air per minute and the exhaust gas temperature is approximately 500° F. Here it is possible to generate 3120 lbs of low pressure steam per hour. This means that when this steam is converted into refrigeration there will be at least 160 tons of refrigeration available per hour for engine use.

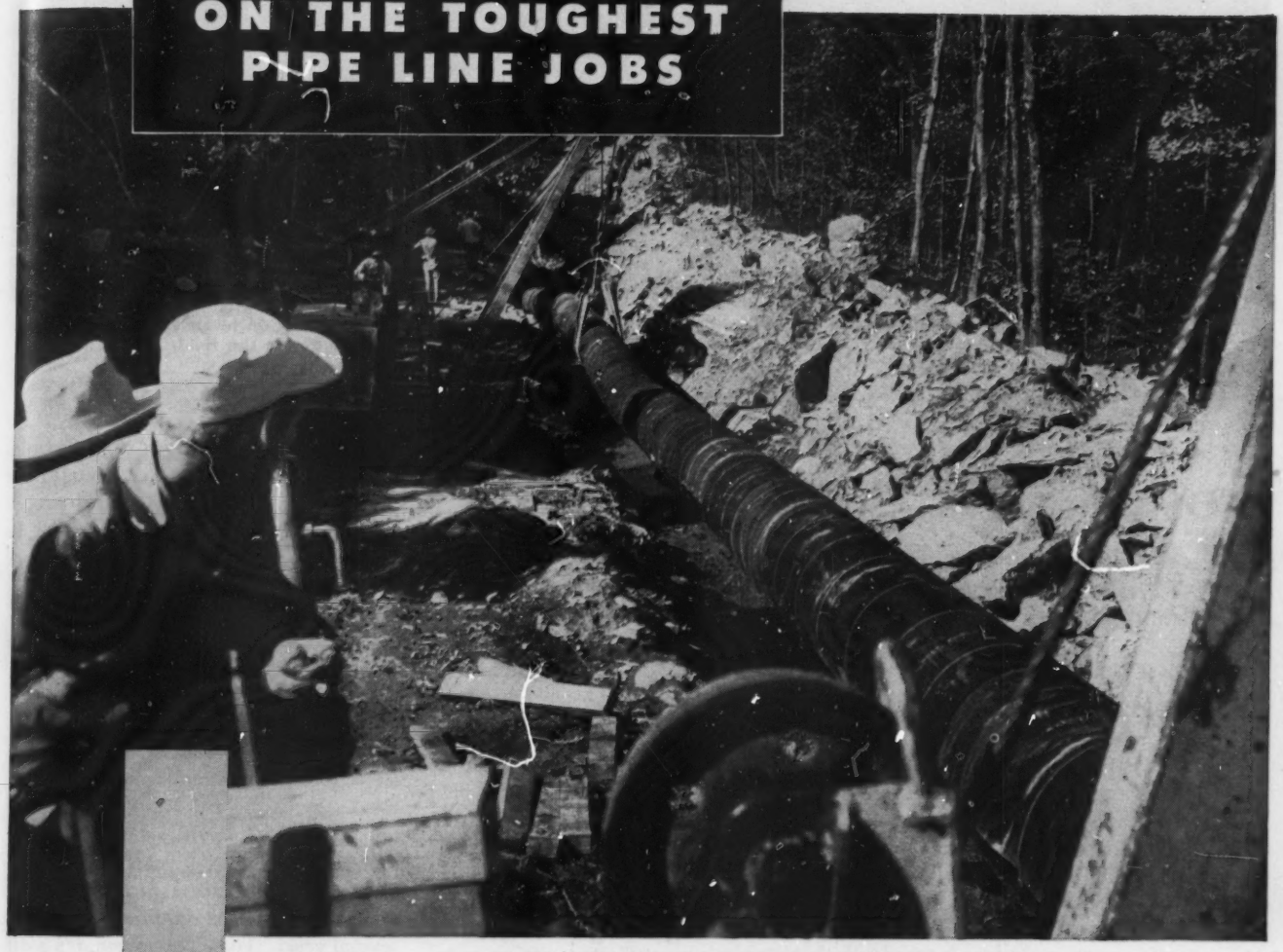
Availability of both heat and cold from normally waste exhaust gases presents some interesting possibilities. By bypassing the refrigeration unit, the waste heat boiler produces steam that can be used for all the purposes normally associated with this form of energy—process steam, space heating, humidification, hot water, or energy for a low-pressure turbine, just to name a few.

Use of the entire unit produces chilled water or refrigeration for processing, space cooling, dehumidification, and other such applications. Selective use of the unit's components provides a means for all-year-around air conditioning with almost zero operating cost.

This IAC equipment described and illustrated is just one more tool in the hands of the engineer to utilize waste heat to advantage. With a little ingenuity, this broadened range of possible methods of waste heat utilization can be integrated into any number of installations.

Recaptured Btu's can be used to increase engine output and efficiency or for any requirement where chilled water can be used to advantage. The overall thermal efficiencies that can be realized will not only amortize the cost of the additional equipment, but will offer substantial savings.

ON THE TOUGHEST PIPE LINE JOBS



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CLAYMONT
WELDED STEEL PIPE
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

As part of its erosion control program, the Natural Gas Pipeline Co. has built terraces like these on farms throughout the midwest. These terraces prevent washing away of soil by directing excess water across the field.

Erosion Control Program Makes Friends for Pipeline

A COUPLE of years ago Joe Hauschel, a Morrowville (Kan.) farmer, looked wistfully across at his neighbor's farm as a group of pipeliners were finishing a cleanup job and said:

"I sure wish that pipeline ran across *my* farm."

Mr. Hauschel's remarkable remark was made just a year or so after another Morrowville resident, Arthur Decker, had refused to accept any damage claims for leak repair work made on his property by Natural Gas Pipeline Co. of America.

"I'm getting more benefit from those terraces than you fellows are," declared Mr. Decker. "I don't want any damage payment."

The terraces to which Mr. Decker referred were laid out in his wheat field by the Chicago firm in its continuing program of soil erosion control. Mr. Hauschel's envy of his neighbor stemmed from a growing realization by hundreds of farmers along the right-of-way of the long-distance pipeline that any man who has a pipeline running through his property is a pretty lucky fellow. For at no cost to himself he's going to get the benefit of erosion control work done by a group of experts who've been at it for two decades.

Natural Gas Pipeline Co., a Peoples Gas of Chicago affiliate, has been in the vanguard of soil erosion control proponents ever since it began constructing its first pipeline (a pioneer in long-distance gas transmission) in 1931. Since then it has taken a problem of self-interest and fashioned it into an excellent tool for building goodwill.

The reactions of the two Kansas farmers would have been no less than startling back in the middle '30s, but today they are almost commonplace in certain sectors traversed by Natural Gas Co.'s line. Natural's activities began so early, preceding by several years the government's own organized program, that a real selling job was required for the first several years. Today, of course, it's a different story. Erosion control districts have long since been organized, and the company has plenty of technical help as well as a world of acceptance among progressive farmers.

In 1952, a tour across farms crossed by the right-of-way would turn up a variety of control measures—terraced fields, grassy waterways to carry runoff water, small dams and weirs of sheet piling, concrete, or crushed rock to halt formation of gullies; farm ponds and pile dikes in streams to prevent bank erosion; standardized methods for halting the sloughing off of valuable topsoil and unusual methods devised by the company to fit particular situations.

Natural Gas Pipeline has won such an outstanding reputation in the field that its projects have been studied by delegations from several agricultural colleges and companies in other industries.

A Natural Gas Pipeline Co. crew uses a special pile driver to pound a sheet piling weir structure into place across a gully to stop erosion.

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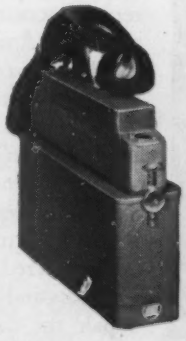

Motorola

Communications & Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois
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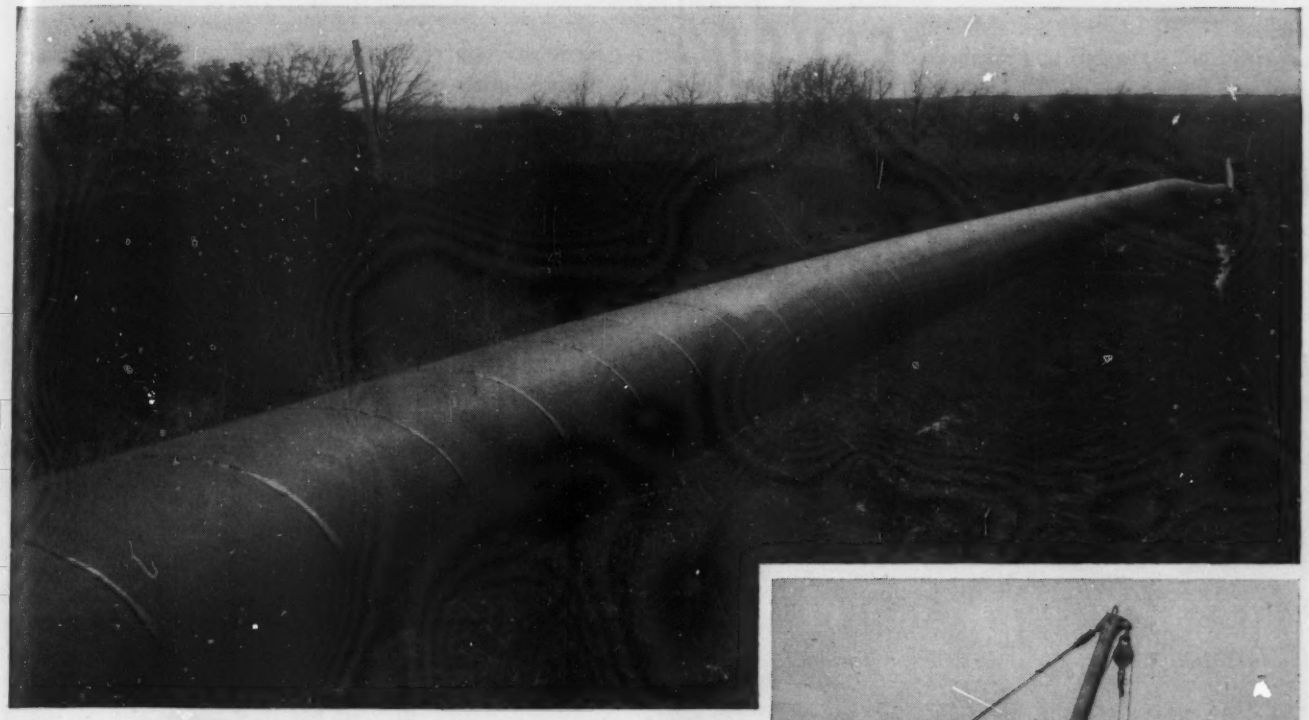
Right, the pile dykes shown will prevent a meandering stream from widening its bed. The stream, now only a trickle, will be several feet wide in the spring.

Below, a company employee stands above a weir structure that has been in use for some time. The structure acts as a dam. It backs up water cutting a gully, causing silt in the water to settle and fill the gully.

Two events in 1931, occurring before the line had been placed in operation, unexpectedly projected the company into the midst of the soil erosion picture. A small tributary overflowed during a heavy rain, washing the backfill from the line on the west bank of Silver creek at Mile 590 in Mills county, Iowa. The loss of fill and extreme bank erosion caused a joint (rubber jointed steel couplings were used at that time to connect 80-ft sections) to pull from a coupling. Shortly afterward, another heavy rain, this time in Bureau county, Ill., washed out the backfill on a hillside and the buoyancy of the pipe in the now water-filled trench carried away two sections.

Company men soon realized they were in the erosion control business whether they liked it or not. There was no agency to which they could turn. The Department of Agriculture had available a smattering of pamphlets covering a few practices such as gully control using check dams, tree and shrub planting. But not anything approaching a complete program and including such presently accepted methods as contour farming, terrace construction, legume and grass planting. And the problem was growing steadily worse as unscientific farming practices continued to aggravate the situation. Excessive runoff or wind erosion caused sheet erosion on hillsides and gully erosion in depression; thin soils were in crops; slopes were being plowed up and down hill; pastures were severely overgrazed.

A cut-and-fill program was begun to repair the damage already done. Wire



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Bitumastic Enamels now available from Koppers new Fontana, California, Plant!

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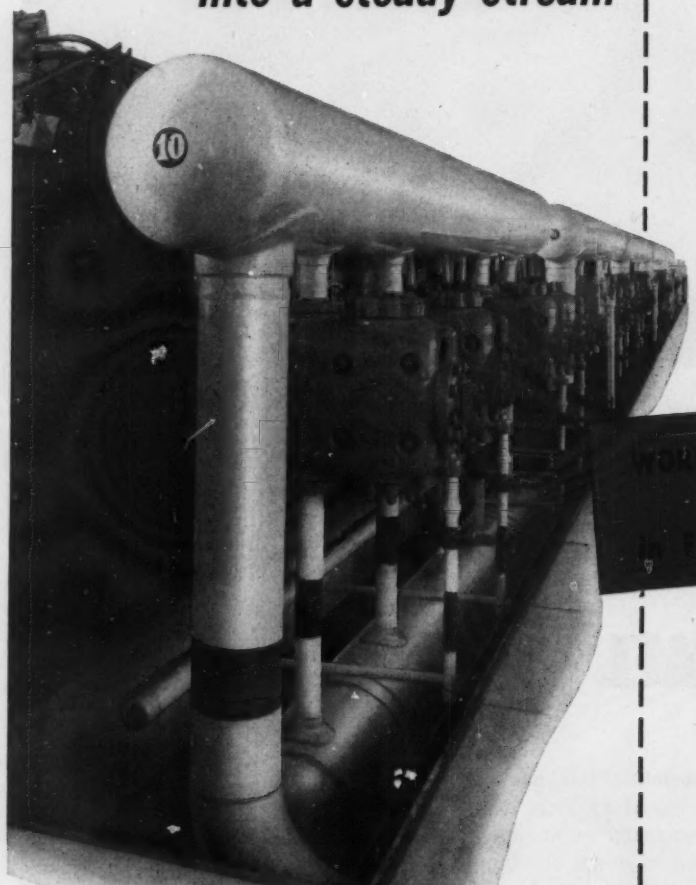
FLUOR

Pulsation Dampeners

convert a pulsating flow into a steady stream



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Fluor Pulsation Dampeners are used on any type gas stream—air, steam, hydrocarbons—at operating pressures ranging from vacuum to 5,000 psi. Dimensions can be tailored to fit space limitations. Units may be installed on the suction and/or discharge lines and are sufficiently flexible to meet minimum pressure drop requirements.

guaranteed

Performance and workmanship are guaranteed in every instance where a Fundamental Pulsation Dampener or Pulsation Dampening System is installed. Here are excerpts from the guarantee:

"The Fluor Corporation, Ltd., guarantees that the pulsation dampeners or pulsation dampening systems . . . conform to all specific code requirements, and the workmanship is in accordance with standard shop practice by qualified welders."

". . . that the equipment will satisfactorily correct conditions of piping vibrations which are due to excessive pulse pressure in the piping system, or correct inaccurate gas metering caused by pulsative flow . . ."

". . . that the dampeners or pulsation dampening systems will decrease the magnitude of the pulse pressure in the compressor plant header piping to a value not to exceed 1.25 percent of the compressor operating pressure. The above percentage reduction applies to both suction and discharge pulsation dampeners or dampening systems . . ."

". . . that the pulse pressure in the plant header piping will not exceed the pulse pressure which is measured in the lateral between the volume bottle and the suction or discharge header, respectively."

". . . that the total pressure loss through the pulsation dampeners or pulsation dampening systems, measured by means of a differential pressure indicator and expressed in pounds per square inch, will not exceed the value set forth on the attached Dimensional Outline Sheet or layout drawing . . ."

Contact your nearest Fluor representative for the answer to your specific pulsative flow problems. Following preliminary study, he will be pleased to recommend the Fluor Pulsation Dampener that best fits your particular requirements. Or, write The Fluor Corporation, Ltd., Los Angeles 22, California.

Two Fluor "Package Type" Models

Fluor Pulsation Dampeners are available in two models: the Fundamental and the Higher Frequency. The Fundamental is recommended for installation in all compressor piping systems where excessive vibration is caused by peak pulse pressures at the fundamental frequency. The Higher Frequency Pulsation Dampener is recommended where frequencies are encountered above the fundamental (second harmonics or higher frequencies).

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and brush dams were built, channels were straightened, willows were planted for stream bank protection—yet it was still necessary to haul in dirt to renew backfill and erect dams of woven wire, lumber slabs or brush. It required hand labor, it was expensive, and, for most part, the measures were temporary.

Then, too, the farmers were either uninterested or openly hostile, and they usually demanded the maximum damages for every entrance onto their fields or pastures. So the company had a first-class public relations job on its hands to get even a measure of acceptance, let alone active cooperation.

After the drouth and dust storms of 1934 and 1936 had wrought their heavy damage, the government began lending a helping hand. In 1935, demonstrations were made by CCC camps and U. S. Soil Conservation Service. Operating men studied the approved techniques and learned how cooperative arrangements might be established with the farmers. In 1937, state legislatures joined the parade, enacting enabling legislation to permit farmers to organize conservation districts. The U. S. Soil Conservation Service was directed to work only through these districts to furnish technical know-how as well as plantings materials and loan equipment.

An added push to the company's own efforts was afforded by a line break in Bureau county, Ill., in February of 1938. A high water table and the force of buoyancy in a light peat backfill caused a rupture which put the line out of service for 40 hours and 51 minutes. The company immediately embarked on a program of welding sleeves over couplings in all sections of the line subject to flooding. Channels were straightened, banks were protected, permanent structures were installed in the smaller waterways.

A complete stabilization of backfill from market back to gas sources was begun; by 1942 this had extended all the way back from Joliet, Ill., to central Iowa. Since that date, no service interruptions traceable to soil erosion in this sector have occurred.

It was in 1942 that the program really shifted into high gear. All of the states along the right-of-way had, by that date, passed enabling legislation. At the Lincoln (Neb.) and Milwaukee offices of the U. S. Soil Conservation Service, company men entered into a direct program of cooperative planning and control. Extensive surveying, mile by mile, and careful patrolling were instituted. All locations needing attention were listed.

During the following winter, the company and the conservation service, as a team, worked to secure farmer cooperation and laid out the work for the following year's program. Complete programs on areas adjacent to and on the rights-of-way were mapped out. In February of 1943, a three-day school was held to acquaint company personnel with techniques and practices. By spring, the company was ready to move onto the farms. Units consisting of tractors, bulldozers, disc terracers, scoops, blades, and mowers worked each farm consecutively, according to a pre-arranged schedule. Shifts were set up to provide a 70-hour productive work week.

In the winter of 1943-44, new schools were established, new techniques were studied, and the entire program was broadened. Through the years it grew, until by 1950 every mile of the line from Amarillo (Texas) field to Joliet was brought within a soil conservation district.

Today, the company (and its affiliate, Texas Illinois Natural Gas Pipeline Co., which has instituted similar conservation measures) can look back upon a program that has brought untold benefits, both direct and indirect. The loss of as much as 50% of the topsoil has been halted. Only two line breaks during an 18-year period were traceable to erosion. Pipeline company personnel, by working closely with the farmers, have become good citizens in the community. The farmers have increased their income. The gospel of conservation has now been spread well beyond the limits of the right-of-way.

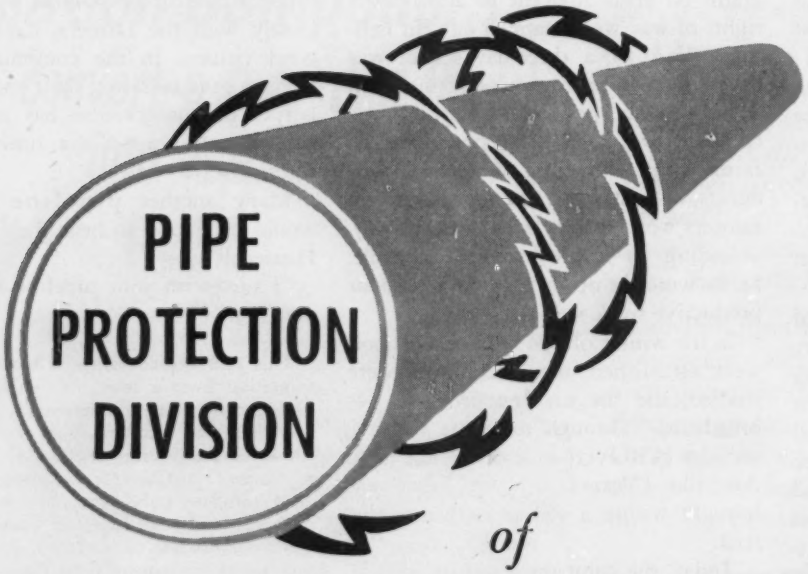
Many another pipeline company would be happy to hear their own Joe Hauschels say:

"I sure wish your pipeline ran across *my* farm."

This staff-written article is based upon information from a story, "Pipeline Company Pioneers in Soil Conservation," which appeared in the October issue of *Gas News*, employee publication of Peoples Gas Light & Coke Co., Chicago, supplemented with other company publications and reports. One of these, titled "Our Pipelines Take to Cover," was a compilation of laudatory stories from a number of newspapers along the right-of-way, including impressive feature articles from the Omaha *World Herald* and the *Nebraska Farmer*.

Photos courtesy *Gas News*.

Unchecked water has mutilated the once productive farm land shown here. The field will heal slowly as conservation measures are applied.



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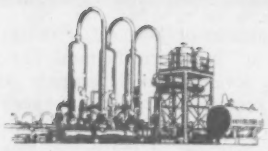


Corrosion of Carbon Steel In Gas Processing Plants

By D. E. McFADDIN
Union Oil Co. of California

THE problem of H_2S and CO_2 corrosion in processing petroleum hydrocarbons is far from being completely understood or solved. However, experience during recent years has taught us many things and it is believed that further progress can result from studies of individual case histories such as our experiences in the Santa Maria valley (Calif.) oil field.

It should be remembered that the majority of all petroleum gases and vapors contain at least traces of H_2S and CO_2, which are by nature considered to be corrosive to metals in common use. It is thus a natural tendency, whenever corrosion is found in a gas or vapor stream, to inquire what the CO_2 and H_2S content of the gas is, and then, with an air of finality, to blame the corrosion on this factor, overlooking the very important fact that no corrosion problem is found in many other cases where the CO_2 and H_2S content is much greater. In this manner, several years ago severe corrosion in compressor after-cooler coils was attributed to H_2S concentrations of less than one grain per 100 cu ft, and likewise, the necessity of replacing still trays was attributed to corrosion from a few percent of CO_2 together with less than a grain of H_2S.

Consequently, it was with great trepidation that the task of processing gas at the Santa Maria valley oil field, containing 7% CO_2 and 15 grains H_2S, was undertaken by the Union Oil Co. in 1943.* Subsequently these concentrations increased to 18% CO_2 and 40 grains H_2S in the composite plant intake and it was necessary to install a Girbotol monoethanolamine unit to reduce the CO_2 concentration to marketable limits. Corrosion at the plant, as would be expected, has been severe and costly, especially in the CO_2 and H_2S removal units. The following conclusions are based largely on observations at this plant, which in addition to the conventional compression, absorption, fractionation, and dehydration operations also includes a Ferrox H_2S unit, which removes approximately 85% of the H_2S from the first stage compressor discharge gas (75 psig). The gas then flows to the Girbotol MEA unit, which in turn removes the required amount of CO_2, together with a small additional portion of the H_2S. Complete and final removal of the H_2S is effected in iron oxide beds at the discharge of the second stage of compression (200 psig). The gas is next processed in the conventional absorption plant units. The intake for the plant is gathered from the field under a slight pressure so that oxygen is not present at the Ferrox or MEA units; however, it is necessary to inject 1% of air to the iron oxide beds in order for these units to operate properly.

A portion of the extracted CO_2 from the MEA unit is purified and converted by compression and expansion into dry ice.

General conclusions derived from the operation of this equipment are enumerated as follows:

1. Corrosion due to CO_2 is no problem even with 100% CO_2 and high pressures, provided no water is present. A gray protective carbonate is formed on the internal surface of the steel and corrosion does not progress into the metal. Copper, brass, and nickel also give satisfactory service.

2. Free water in the presence of CO_2 becomes acid, which is highly corrosive.

3. Hydrogen sulfide, similar to CO_2, will directly attack steel and most other metals in general use. The metallic sulfides in general are softer and more bulky than the carbonates and trouble from them is sometimes found in the plugging of burner tips and control equipment made of copper or zinc alloys. However, the actual loss of metal in these instances is usually not great.

4. Hydrogen sulfide reacts readily with certain hydrate oxides of iron and, consequently, severe corrosion from H_2S is usually limited to locations where moisture and oxygen are present.

5. The combination of H_2S plus CO_2, plus water, is much more corrosive than combinations in which either H_2S or the CO_2 is absent, or is present in relatively small amounts. For example, the corrosion in an amine plant operating on either H_2S or CO_2 can be expected to be much less than when processing gas containing both, and confirming this, marked increases in corrosion were found at Union Oil Co.'s Santa Maria plant whenever the H_2S content in the gas from the Ferrox unit to the MEA unit increased to above a few grains. The interdependence of H_2S and CO_2 in this respect is apparent from the formula:

(a) $Fe + 2CO_2 + 2H_2O \rightarrow Fe(HCO_3)_2 + H_2$

(b) $Fe\ (HCO_3)_2 + H_2S \rightarrow FeS + 2H_2CO_3$

The iron is first dissolved as ferrous bicarbonate and then precipitated from the solution by the H_2S as ferrous sulfide. We then have a fouling problem in addition to a corrosion problem. Since the ferrous bicarbonate is more soluble than the ferrous sulfide, and assuming a continuous supply of CO_2 and H_2S, it is apparent that corrosion can proceed as long

*For a description of the process, see "Utilization of Carbon Dioxide Extracted from Natural Gas in the Production of Dry Ice," by C. D. Gard, *GAS*, Feb. 1949, pp. 30-36.

This paper was presented before a meeting of the California Natural Gasoline Assn.

as iron is exposed to the attack. However, the rate and extent to which the iron is dissolved by the MEA solutions is dependent upon the CO_2 saturation and temperature as well as by impurities and other substances present. In general, it has been found that the attack proceeds rapidly at temperatures above 265° F, and the equipment and process should be designed to permit operating at temperatures below this temperature and also to employ low velocities and small temperature differences.

6. The use or presence of caustic or alkaline materials has been suggested for neutralizing the acid gases, H_2S and CO_2, and the injection of small amounts of ammonia has been advisable in mitigating corrosion in absorption plant stills. However, corrosion in the soda-ash and MEA streams of the Ferrox and Girbotol units at the Santa Maria plant has been exceedingly severe, probably because the oil and other protective films are kept cleaned away by these alkaline materials. It is therefore suggested that caution be applied to the use of neutralizing agents.

7. Protective films composed of lubricating oil, crude oil or some other material, such as glucosides, often prevent the corrosion from becoming a problem. However, lighter fractions apparently do not give protection and severe corrosion is found in gasoline condensers and gas coolers where all traces of crude or lube oil have been removed. Similarly, extensive corrosion is found in condensate wells whereas corrosion in heavy crude oils is limited to areas of the casing and tubing from which the oil has been washed away by the condensation of water and light hydrocarbon vapors.

8. Galvanization for lease storage tanks has been found effective in combating corrosion in the vapor zone.

9. The gas gathering system is generally fairly well protected by entrained crude oil.

10. Compressors should be satisfactorily protected by lube oil which may be injected directly into the compressor cylinder intake to protect the intake valves and valve springs.

11. CO_2 corrosion resulting from steam condensation in heater and reboiler units and in steam and steam condensate lines is best controlled by proper processing of the boiler feed water to remove all potential CO_2 including the conversion of bicarbonates to CO_2 plus carbonates. Protective films have also been found effective in this case.

12. CO_2 and H_2S attack steel in several manners, as follows:

Stress corrosion. This is a major problem in MEA plants and is found in the piping or vessels carrying the liquid amines. It is characterized by a small "pin hole" or short crack near a weld, and since the full thickness of the metal remains adjacent to the crack, the leak may be patched. Annealing has been found effective in mitigating this type of corrosion. It has also been suggested that lignins or nitrates would be helpful in combating this problem. This type of corrosion is found in other chemical processes and usually reflects a case in which the rate of attack depends on differences in temperature and concentrations. The chemical reactions involved are the same as given in Paragraph 5 above.

Stress corrosion has also been found in compressor second stage intake valve springs and plates where CO_2 and H_2S and water mist were present and where lube oil was not used to protect these parts. The springs would sometimes break after a few days use and long and rather wide cracks would penetrate the plates after about a week. The valves in first stage service received protection from entrained crude oil from the field.

It has also been observed that embrittlement may occur when steel under strain is exposed to H_2S. In one such case a "rolled-up" type angle flange cracked and it was found that the sulfide had penetrated the metal so that it could not be satisfactorily welded.

"General" type. The corrosion observed in the vapor zone of CO_2 and H_2S where water is present is of the "general" type and is most severe where the water accumulates, such as on the bottom of horizontal pipes, the outside of elbows, etc. H_2S is not essential to this type of corrosion and we have observed very severe corrosion in cases where the H_2S had been removed. It is usually advisable to keep the lines and equipment well drained of water to minimize this type of corrosion.

"Erosion" type. This is often formed by CO_2 and H_2S due to the softness of the corrosion products. It is therefore advisable to keep velocities to a minimum. Some streams, such as MEA, carry suspended solids such as FeS and $FeCO_3$ which erode away any protective films that may form on the metal. Means should be provided for the removal of these solids by distillation, filtering or settling.

PIPELINE PEOPLE

Appointment of JAMES L. PARMELEE as manager of Northern Natural Gas Co.'s new area development department was announced recently. With the company since 1931, Mr. Parmelee has most recently been active, as manager of the exploration division, in negotiations for a gas supply in Canada. His duties in the new department will be to assist in the development of industry, agriculture and natural resources in the area served by the Omaha company.

J. L. Parmelee
Northern Natural

Ed Dewey
Fluor

ED DEWEY, formerly with Dozier-Eastman & Co., advertising agency, has been appointed supervisor of sales promotion for the Fluor Corp. Ltd., Los Angeles. As account executive, Mr. Dewey has for the past four years serviced the Fluor advertising, merchandising, sales promotion and a recruiting drive for skilled help in Saudi, Arabia.

With the formation of a new district designated the Albuquerque (N. M.) district, Southern Union Gas System, Dallas, has announced the promotion of four men. E. C. REDDY was made manager of the new district and ARTHUR JONES GREEN, formerly Carlsbad district transmission superintendent, replaces Mr. Reddy as manager of the Carlsbad (N. M.) district. Simultaneously, former Santa Fe district manager TOM CORR and assistant district manager T. A. WILSON were promoted to northwestern New Mexico division manager and assistant division manager, respectively. The division includes the new Albuquerque district and the Santa Fe district.

ERNEST O. OHSOL has joined the Pittsburgh Coke & Chemical Co. as director of chemical engineering. He will be responsible for economic and engineering evaluations of major chemical projects and will supervise development of process design and specifications. Dr. Ohsol was formerly at General Electric Co., Pittsfield, Mass., and Esso Research Center of Standard Oil Development Co.

E. H. TOLLEFSON was recently elected executive vice president of Hope Natural Gas Co., Clarksburg, W. Va. by the board of directors. A veteran of 27 years in the oil and gas industry, Mr. Tollefson joined Hope Natural in 1939. He was formerly vice president in charge of operations.

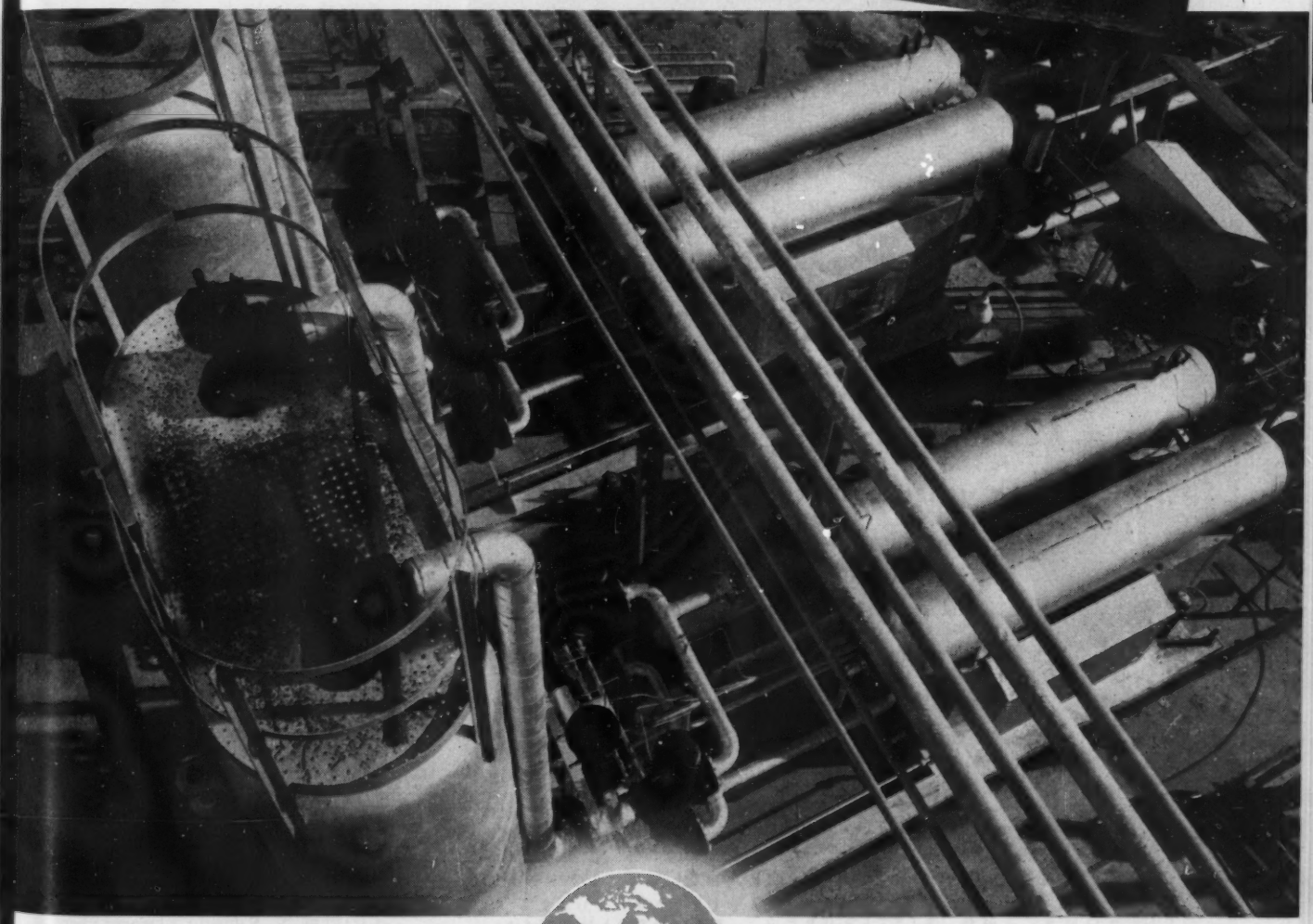
F. C. GARDNER has been elected executive vice president of Ebasco Services Inc., New York. K. W. REECE has been elected to succeed Mr. Gardner as vice president in charge

National Dehydration Units

SPECIFIED FOR 10 NEW PLANTS

Nearing completion is the Baxterville plant utilizing two 50 M^2CFD National Dehydration Units. Construction of nine other plants by the world's largest handler of natural gas is in progress. These 10 plants will use 20 Dehydration Units and all will be National.

National Dehydration Units are designed to remove water from natural gas efficiently and economically, in a unit that is compact, portable and automatic.



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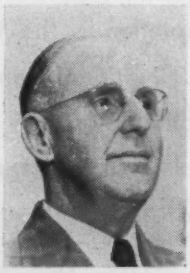
of engineering and construction, and W. H. COLQUHOUN has been made engineering manager to fill Mr. Reece's former position. Mr. Gardner joined Ebasco in 1939 and Mr. Reece in 1925; both men were appointed to their former positions in 1945. Mr. Colquhoun, formerly assistant engineering manager, has been with the company since 1941.



C. R. Maranville

C. ROBERT MARANVILLE has been elected assistant treasurer of Worthington Corp., Harrison, N. J. Mr. Maranville has been with the company in various capacities for 16 years. His most recent position was assistant to the works manager of the company's Holyoke, Mass. plant. IRVING AUGUST has been appointed to succeed Mr. Maranville. Formerly superintendent of the company's Denver, Colo. plant, Mr. August has been succeeded by MERRIL BERMAN, who was project engineer in the company's vertical turbine pump division.

JAMES P. MORONEY of Denver has been named vice president of Colorado Interstate Gas Co., Colorado Springs, and its new subsidiary, Colorado Oil & Gas Corp., which will carry out exploration and production operations for the firm. Mr. Moroney was formerly vice president and Rocky Mountain manager for Sinclair Oil & Gas Co.

Obituaries

SAMUEL J. BRENDEL, 69, Shadyside, Pa., the man who touched off the 1919 gas boom in McKeesport, Pa. and became a multimillionaire, died last month after a long illness. He was president of the S. J. Oil & Gas Co. and the Samuel J. Brendel Producing Co.

H. C. Cooper

HOWELL C. COOPER, former president of the Hope Natural Gas Co., the Mississippi River Fuel Corp., and the Colorado Interstate Gas Co., died recently at his home near Pittsburgh. He was 78. Mr. Cooper had been connected with gas and oil companies for many years and participated in the construction of many long distance pipelines prior to his retirement from Hope in 1939. In 1940, he received an award at the International Petroleum Exposition for his contributions to oil industry progress.

CHARLES S. REDHILL, Denver, former president of the Rocky Mountain Oil & Gas Assn., died of a heart ailment last month while he was in Chicago to attend sessions of the American Petroleum Institute. Mr. Redhill, who was 67, had been active in developing properties in the Rocky Mountain area, particularly Wyoming, since 1923.

Four things line pipe men should remember: When you specify steel line pipe, always remember these four essential requirements:

1 Remember uniform quality. You are sure of this with Kaiser Steel line pipe, because it's produced by fully-integrated facilities, completely controlled at every step of production, rigidly tested before it's approved.

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3 Remember prompt service. Kaiser Steel men with long experience in working with the gas and oil industries stand ready to serve you whenever you say the word.

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Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

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PIPELINE NEWS

Producers and Pipeliners Get Government Runaround

Natural gas producers are finding out these days—as hundreds of other industries have before them—how it feels to be taken for an unwilling ride on the Washington merry-go-round.

The process goes like this: the producers association has asked OPS for permission for a price increase. OPS Director Tighe Woods turned down their request, telling them that he cannot grant the increases unless PAD recommends it as being necessary to obtain adequate production. PAD refused to make any statement, however, saying that their authority does not extend to price controls and that any action taken in regard to them should be taken by the OPS.

Unless some change in policy is made by the new administration, the whole question may have to be settled by the courts. One phase of this debate is about to be tested now. The courts have been asked to decide if OPS has the authority to nullify price increases, as they have been doing, under the terms of escalator clauses in producer-pipeline contracts.

Meanwhile, officials of El Paso Natural Gas Co. have announced that they have signed a contract to pay 12 cents per thousand for gas reserves in a 11,000-acre unit in the San Juan basin. This contract is, of course, subject to OPS approval. Recently, the agency refused to approve a contract for 12 cents for gas from the Woodlawn field in east Texas and held the contract to a maximum of 10 cents.

In another development, the Texas Independent Producers and Royalty Owners Assn. was hard at work on two proposals to be submitted to the state legislature. One involves posted field prices. The other is a request that the railroad commission establish minimum field prices. Pipeline companies, however, are not budging in their opposition to further state control. In 1951, they blocked a minimum price bill in the Texas senate although the proposal was adopted by the House with little difficulty.

Texas Eastern Granted $26 Million Increase

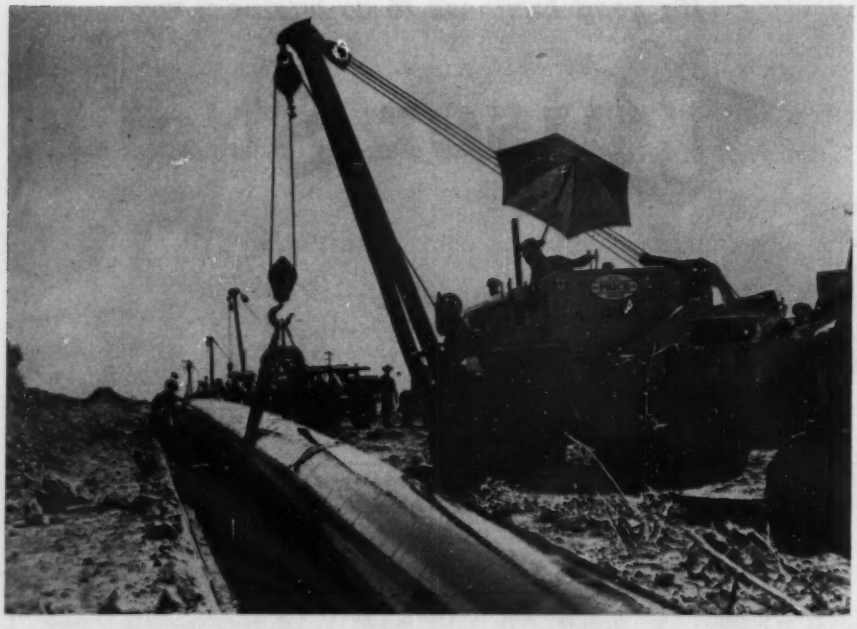
Recent FPC action on applications for rate increases on wholesale natural gas sales includes approval of an interim settlement for one company and suspension of applications for five companies.

Texas Eastern Transmission Corp., Shreveport, will be allowed to put into effect a rate increase totaling $26,180,000, effective Dec. 1. At the same time, the company agreed to reduce its $41 million rate increase proposal to $37 million.

The interim settlement was agreed upon by the FPC and company representatives to obviate the possibility that the $41 million suspended increase would go into effect under bond on Nov. 1. It provides that in the event the FPC has not made a final decision by next September, the company may place into effect, under bond, a $33 million increase.

Rate increases suspended included Natural Gas Pipeline Co. of America, Chicago, $3,511,489; United Natural Gas Co., Oil City, Pa., $1,749,000; East Tennessee Natural Gas Co., Knoxville, $487,000; Tennessee Natural Gas Lines Inc., Nashville, $388,000; and South Jersey Gas Co., Newark, $57,000.

United Natural, East Tennessee, Tennessee Natural Gas, and South Jersey all based their applications for increases on proposed increases by their suppliers. United buys gas from Tennessee Gas Transmission Co., Texas Eastern Transmission Corp., and Manufacturers Light & Heat Co.; East Tennessee Natural from Tennessee Gas; and South Jersey from Transcontinental Gas Pipe Line Corp. The FPC pointed out, however, that these increases are now also under suspension.



H. C. Price Co.'s heavy-duty side-boom tractors ease several sections of 26-in. pipe, coated and wrapped, into trench on Texas Gas Transmission Corp.'s new 408-mile pipeline now about 50% complete.

SoCal and SoCounties Expand Texas Pipeline

Work has begun on the $5 million expansion program of Southern California and Southern Counties Gas Co.'s jointly owned California section of the Texas pipeline.

Initial contracts for the construction of two 5000-hp booster stations at Desert Center and Cactus City in the Indio area were let to the J. B. Gill Co. of Long Beach. Other contracts will cover the erection of the buildings and installation of machinery, electrical and painting work.

The expansion project, which also includes laying of about 20 miles of 30-in. loop line and addition of 3520 hp at the Blythe compressor station, will increase capacity of the system to enable it to carry an additional 300 MMcf of gas daily.

The El Paso Natural Gas Co. was authorized by FPC in July to deliver this additional amount to the system, half of it to go to the southern California companies, the other half to the Pacific Gas & Electric Co., San Francisco. Bids for the remaining construction were being taken in November and contracts were expected to be let with construction to begin early this month.

Northern Natural Forms Separate Producing Firm

A series of fast moving developments surrounding the proposed construction program of Northern Natural Gas Co. was capped last month when the FPC ordered an investigation into the sale and transfer of gas leases and wells by the Omaha pipeline firm to its newly formed subsidiary, Northern Natural Gas Producing Co.

Following the example set by Panhandle Eastern Pipe Line Co. three years ago, Northern had organized the producing company to enable it to divorce its production facilities from FPC control. Announcement of the move had come immediately following issuance of an FPC order modifying the now-famous "dedication of reserves" decision set down last June 24 in connection with the construction program, and with an announcement by the company that it would proceed immediately with the building although it was not completely happy with the new decision.

The decision, rendered at the completion of a rehearing which had been urged by Northern, amended the previous order in that it required that Northern not alienate, sell, or transfer its reserves without prior FPC approval as long as natural gas may be economically produced therefrom "for rendition of the service authorized by the June 24 order." This new condition, said the commission, would not prevent the "normal abandonment or trading of leases or wells for the purpose of improving Northern's gas reserve position or for obtaining

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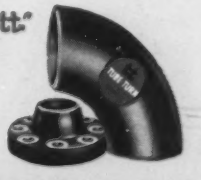
Write Dept. LL-12 for free booklet on Pipe Line Welding Fittings. Use coupon on reverse side.

Be sure you see the double "tt"



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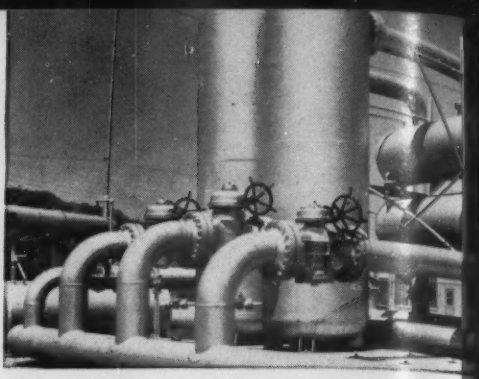
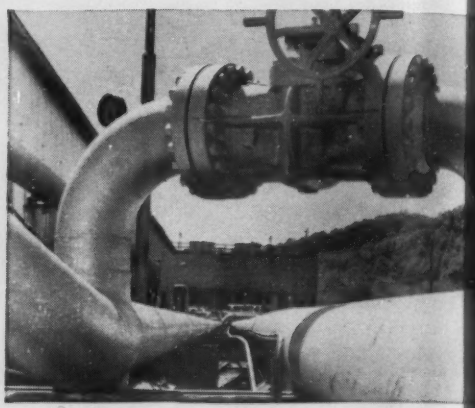
Efficient compressor station piping uses TUBE-TURN Welding Fittings



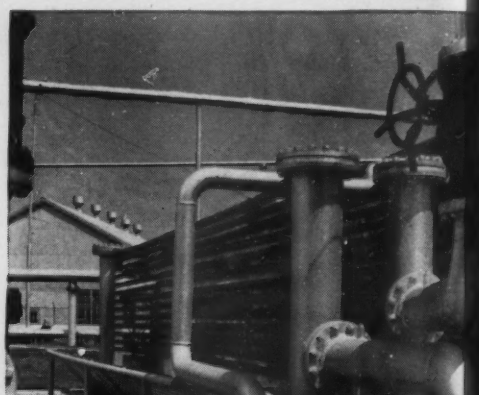
Piping fabrication was simplified by availability of the wide range of TUBE-TURN Welding Fittings and Flanges. All necessary components for complex jobs can be obtained from one reliable source . . . since Tube Turns, Inc. offers the world's broadest line of welding fittings and flanges, covering over 4000 different items.



Pressures of 800 p.s.i. are handled safely by welded 20-inch crossover line. Use of TUBE-TURN Welding Elbows and Flanges makes joints permanent and leak-proof, also keeps flow resistance and pressure drop to a minimum.

The Ohio Fuel Gas Company is known not only for efficient service, but also for its extensive underground storage facilities. In severe weather the company supplies as much as 45% of demand from 625 specially built storage wells.

Round-the-clock dependability is maintained by welded piping systems using TUBE-TURN Welding Fittings and Flanges. Here, at Crawford Station in Columbus, piping joints are tight and secure, and maintenance is reduced to a minimum.



Piping for gas coolers was fabricated smoothly although lines are fitted closely together. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings assure proper fit and simple alignment . . . saving time in construction.

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Tube Turns, Inc. has prepared a new booklet on "Wrought Welding Fittings", discussing their use for pipe lines and compressor stations. Covers design factors and operating problems. Mail coupon for your free copy.

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LOUISVILLE 1, KENTUCKY

more economic or efficient gas production operations."

Requirements in the June 24 order that Northern file a duly authorized corporate undertaking committing its gas reserves, and that it include in its service agreements provisions effecting a commitment of reserves, were dropped. However, Northern must still obtain prior FPC approval when it wishes to undertake a specific transaction affecting its reserves "in form and nature substantially different from the pattern established by its prior operations."

In announcing the start of its construction job, Northern's President John Merriam stated he was convinced that FPC exceeded its powers in retaining this latter restriction in the order, and stressed that the company was not waiving its right to contest it.

The $70 million certificate permits the company to boost its capacity from 600 to 825 MMcf per day. Certain facilities were completed last year, bringing capacity to 675, and an additional 40 MMcf was made available Oct. 6. That portion of the program just started will add another 20 MMcf by Jan. 1, weather permitting. The final 90 MMcf of capacity is scheduled to be ready by next summer.

FPC found something less than complete unanimity among its members in the promulgation of the new order. Claude Draper dissented on the basis that the Supreme Court's decision in the Panhandle Eastern case specifically removed control of producing facilities from FPC jurisdiction. "We cannot do by indirection what we can't do directly," he declared. Chairman Buchanan concurred with the majority, but issued a statement that "we were correct in conditioning our grant of authority as we did in our order of June 24, and as we do here."

Nelson Lee Smith, concurring, reiterated his previous statement that the problem arises from the commission's own rate base approach, and that a more realistic pricing method would solve it.

The new producing firm is headed by John Merriam as president, with other top Northern officers on its executive staff.

Texas-to-Ohio Pipeline to Import Mexican Gas Denied

The FPC, in a unanimous decision, has denied applications by Texas-Ohio Gas Co., Houston, for authority to construct a 1406-mile, 30-in. pipeline extending from Texas to Ohio and to import natural gas from Mexico. The pipeline, estimated to cost $185 million, would have extended from the U. S.-Mexican border in Hidalgo county, Texas to a terminus near Lancaster, Ohio. Texas-Ohio planned to sell all of its gas to Reserve Natural Gas Co., a newly-formed corporation in Ohio.

The commission said it concluded that Texas-Ohio "has not sustained the burden of showing that it is 'able and willing properly to do the acts and perform the service proposed.'" It based its conclusion on the record evidence showing (1) an adequate supply of gas, (2) the ability of Reserve Natural to absorb and pay for the 480 MMcf per day for 365 days in the year, and (3) the economic feasibility of the proposed project.

Texas-Ohio proposed to secure about 232 MMcf of gas from Mexico, 173 MMcf from gasoline plants, and 107 MMcf from gas fields in Texas. The company had submitted a proposed contract—which was never executed—with Petroleos Mexicanos, containing a provision that Texas-Ohio must secure an FPC certificate by July 31, 1952, and commence construction by Sept. 15, 1952.

Hearings on the application, which began last April, were recessed and resumed several times before the motion to deny the authorization was filed.

Frank Champion, president of Texas-Ohio, said the commission's decision is "contrary to both the fact and the law." He indicated that the company plans to appeal the ruling. If the motion is rejected by the commission, an appeal may be taken to the Federal Circuit courts.

Battle Continues Over Line To Serve Pacific Northwest

As the big fight over the last remaining gas pipeline plum in the U. S., the Pacific Northwest, neared its climax last month, both sides brought up their biggest guns.

Canada's official blessing to the Westcoast project (see November *GAS*) has only served to stiffen opposition to the Canadian line. As the Federal Power Commission was getting ready to start final hearings, Ray Fish's powerful Pacific Northwest group was working hard to scuttle Westcoast's project and to present a convincing case for their own proposed line from the Four Corners area of the U. S.

In a sharply stepped up drilling campaign in the Four Corners area, Pacific Northwest claims to have already proven reserves of over 2,500,000 MMcf, enough to serve the northwest market for 20 years. In addition, Pacific Northwest has contracts for some 95,000 acres of gas-producing land in southwestern Wyoming, enough to bring the total reserves available for the line to an estimated 3,500,000 MMcf. And they have secured firm buying orders from practically every major utility in the northwest area with the exception of Portland, and Portland has evidenced interest to purchase, they claim.

Henry Gellert, president of Seattle Gas and now one of the leading opponents of the Westcoast plan, issued a voluminous brief setting forth reasons for his support of Pacific Northwest's plan. They include the fact that the Canadian line, with the U. S. utilities situated at the far end, would make the Northwest a "captive market." Under present Canadian laws, he claims, the Canadians could cut off supplies at any time. He said that the Canadians can give no effective guarantee as to prices and also that the line from the Peace river area presents "serious physical difficulties."

A delegation of Vancouver, B. C. officials, aware that the rejection of the Westcoast plan will leave them gasless, besieged the Seattle city council and presented a case on behalf of the Canadian line. This was promptly followed by a request from Pacific Northwest and others asking that they be given a hearing to present their side of the case. The fact is, however, that the Seattle city council is without any authority whatever to decide one way or the other, the whole question being up to the FPC.

One of the strongest points seen favoring the Canadian proposal—the trend by the government in recent months toward conservation of U. S. natural resources—is not a factor that comes directly under FPC jurisdiction. Since such powerful international considerations are involved, the whole question may have to be settled ultimately by top government officials, possibly by the new President and his cabinet.

Natural gas from Peace river fields in Canada will move to Northwest cities by this route, if Westcoast Transmission wins approval to enter states. The 960-mile line could be completed in two summers, said company officials, who added that financing for the $11 million project is available. Laterals would supply many western Washington cities. Coquihalla pass, 3650 ft high, will be bypassed if Spokane branch line can be constructed at same time.

100-Mile Extension Ok'd For East Tennessee System

The Federal Power Commission has authorized East Tennessee Natural Gas Co., Knoxville, Tenn. to construct a 100-mile extension of its natural gas transmission system, from a point near Knoxville to the Kingsport, Tenn. area. It also approved approximately 58 miles of various sized lateral lines.

The project, which will cost approximately $5.8 million, will provide natural gas to Morristown, Johnson City, Elizabethton, Bristol, Greeneville and Kingsport. The authorization was conditioned, however, to require East Tennessee to file appropriate evidence of franchise authorization for distribution of gas in Greeneville and Kingsport

before beginning construction of the project.

In the same ruling, FPC denied authorization of a 5.5-mile lateral to provide service to Jefferson City, Tenn. and construction of metering facilities to serve five industrial customers. It based its denial on the lack of evidence to show that the markets, including Greeneville and Kingsport, actually exist.

New York Natural Plan Partially Approved

Temporary authorization has been granted the New York State Natural Gas Corp., New York, to construct 20 miles of 16-in. natural gas pipeline and 970 feet of 20-in. line. A proposed 75-mile, 20-in. line in the same application, planned for construction in 1953, was not covered by the FPC authorization.

The 20-mile line will extend southwest from a connection with an existing line in Clinton county, Pa. to a point near the newly discovered Driftwood gas field in Cameron county, Pa. and the short 20-in. line will be built to connect the company's Sabinsville compressor station with existing transmission lines. The proposed 75-mile line would extend from the southern end of the 20-mile line to a connection with New York State Natural's main dual line transmission system in Armstrong county, Pa. The total estimated cost of all these facilities is $5,332,506.

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Williamson Pipe Line Pigs*
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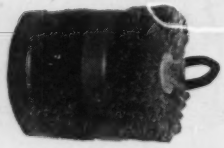
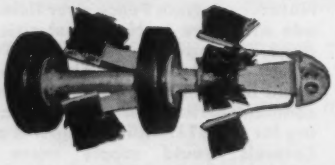
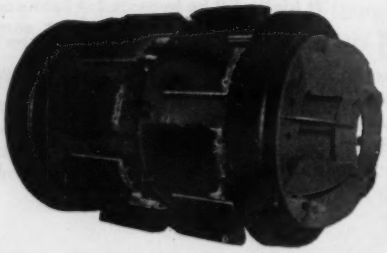


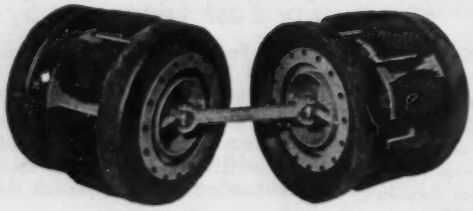
4" Size—TYPE JRN. 2" to 4" sizes. Will pass 1½ R-90° Bends. No valves other than full diameter thru port valves. Use TYPE SCN-51 for 6" size.



8" Size - TYPE WC-11. 8" to 14". Will traverse 6-foot radius field bends, full diameter side openings at 45°. SPRINGS COMPENSATE for BRUSH WEAR.



20" Size - TYPE GP-2. 16" to 30" 200-lb. SPRING forces the brushes against pipe wall — COMPENSATING for WEAR. Will traverse round opening gate or plug valves. SPRINGS and BRUSHES are identical and interchangeable for all types and sizes of GP-PIGS.



24" Size - GP-3. 18" to 30". Sizes will pass 1½ R-30° Bends. SPRINGS COMPENSATE for BRUSH WEAR ASSURING full section cleaning efficiency.

GP-3 consists of two Type GP-1 Pigs —Each Unit may be used as individual pig.

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New Englanders Support Algonquin Certificate

Algonquin Gas Transmission Co., whose progress with its New England line has often been bitterly contested by residents, now finds itself with a host of New England friends.

After the Supreme Court's decision that voided Algonquin's certificate and sent the whole case back to the FPC (see November *GAS*), a storm of protest arose in communities about to be served by the Algonquin line and officials and residents alike hurried to the nearest telegraph office to urge FPC to issue a temporary certificate so that the little work left to be done on the line could be completed.

However, the FPC decided that it does not have the authority to issue such a certificate, and Algonquin's application was refused. More protests followed. Finally FPC announced that it would reconsider the question and would hold a hearing to listen to argument "on the single issue of whether or not Algonquin's application for a temporary certificate comes within the purview of the authority of the FPC to grant." As *GAS* went to press the whole question was still very much up in the air.

Meanwhile, Algonquin estimated that the delay was costing it $32,000 a day. A company spokesman said that gas is ready to flow through the completed mainline to a number of New England outlets as soon as the authorization is granted and that the remaining lateral lines could be finished in 15 days.

Hearings on the whole question of who is to serve the New England market were scheduled to begin late last month. However, unless the commission changes its mind and issues a temporary certificate, areas that were to be served by Algonquin will probably be without natural gas until next spring, at least.

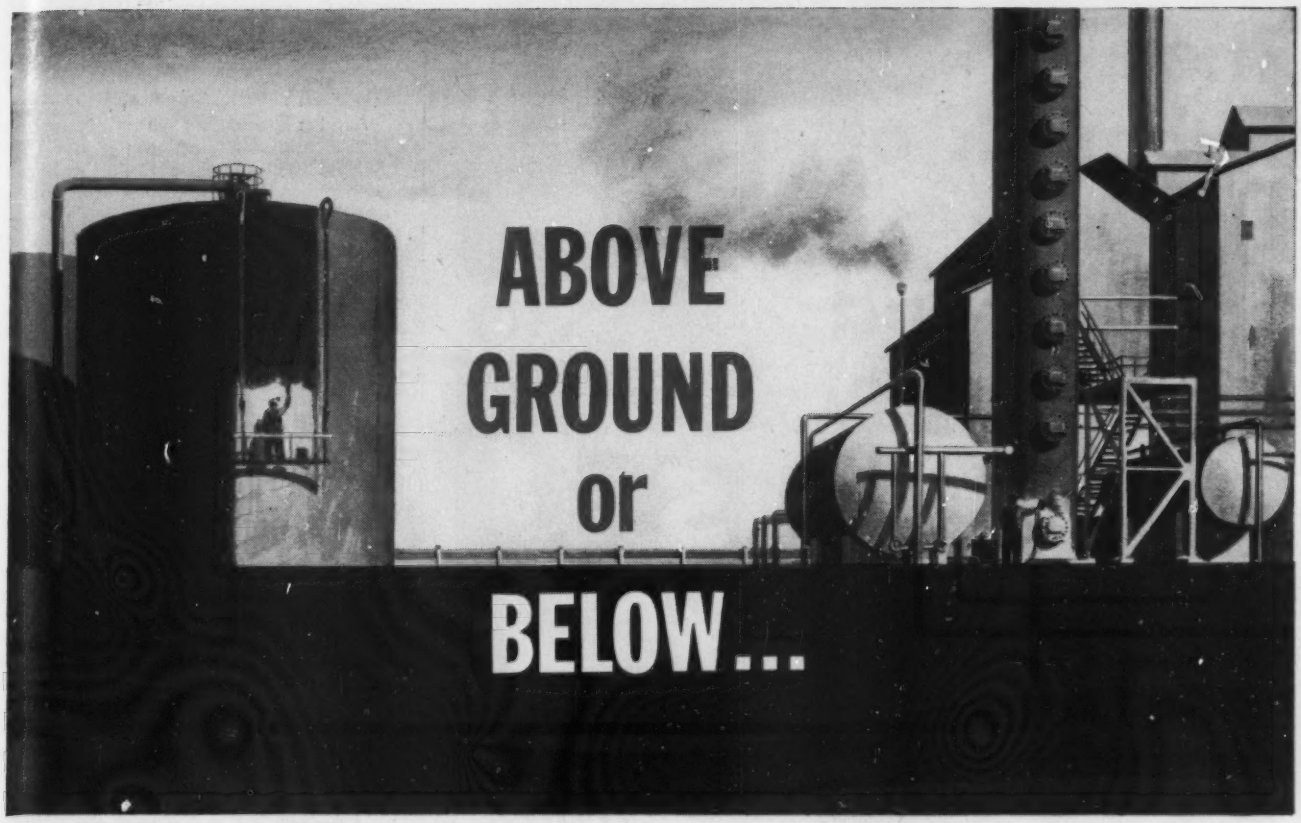
FPC Approves Southern Natural Gathering System

The FPC has authorized Southern Natural Gas Co., Birmingham, Ala. to construct a gathering system as part of its proposed project estimated to cost $76 million, which will be used to carry natural gas from 12 fields in southern Louisiana and southern Mississippi.

The approved facilities, which include more than 326 miles of pipeline and approximately 8700 hp compressor capacity, will cost about $32,518,500. Construction crews are now at work on two sections of 24-in. line totaling about 88 miles, which was previously approved.

The company has also been granted temporary authorization to construct about 16 miles of loop and a submarine crossing of the Etowah river. These facilities, which will enable Southern to meet the requirements of a customer, Atlanta Gas Light Co., will cost about $895,900.

The gathering system authorized in the ruling includes a 67.8-mile, 24-in. line extending south from the company's Gwinville (Miss.) compressor station to Franklinton junction, La., with a 19-mile, 8-in. lateral extending east to the Sandy Hook (Miss.) field, and the addition of 5400 hp capacity



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at the Gwinville station. A 109.5-mile, 20-in. line will extend southwest from Franklinton junction to Duck Lake gas field, with 12.7 miles of 10-in. line continuing to the Lake Sand field, both in Louisiana.

Another 20-in. line extending southeast from Franklinton junction will run 117.6 miles to a point in Puaquemines parish, La. with lateral lines to various fields in that state. A new 3300 hp compressor station is to be installed on this line at Estopinal, La.

The new facilities will increase the daily delivery capacity of Southern's pipeline system from 670 MMcf to 1020 MMcf. The delivery capacity of the pipeline from Franklinton to Gwinville will be 298.7 MMcf per day, exclusive of fuel used at the Gwinville station.

Midsouth To Serve 25 Arkansas Communities

Two applications of MidSouth Gas Co., Little Rock, Ark. were recently approved by FPC. The construction of 191 miles of lateral pipelines covered by the first application will enable MidSouth to serve natural gas to 25 communities in Arkansas, and through the 38-mile line, to be acquired from Arkansas Power & Light Co., Pine Bluff, it will serve that company's Hamilton Moses steam electric generating station near Palestine, Ark.

The 38-mile line will carry gas from the system of Texas Gas Transmission Corp. at a point near Helena, Ark. MidSouth will also serve 20 communities with gas from Texas Gas, and the remaining five communities with gas purchased from Texas Eastern Transmission Corp. Estimated cost of acquiring the Arkansas Power facilities and construction of new lines is $4,524,200.

East Ohio Plans Expansion

The East Ohio Gas Co., Cleveland, plans to spend $17 million in 1953 to provide more gas for its consumers. About two-thirds of it will benefit those in the Cleveland area. Plans include construction of a 125-mile, 26-in. pipeline costing approximately $7.5 million. The line, which will provide 75 MMcf additional will connect to the Panhandle Eastern pipeline at the Maumee river just south of Toledo. Distribution lines will cost approximately $6,851,000.

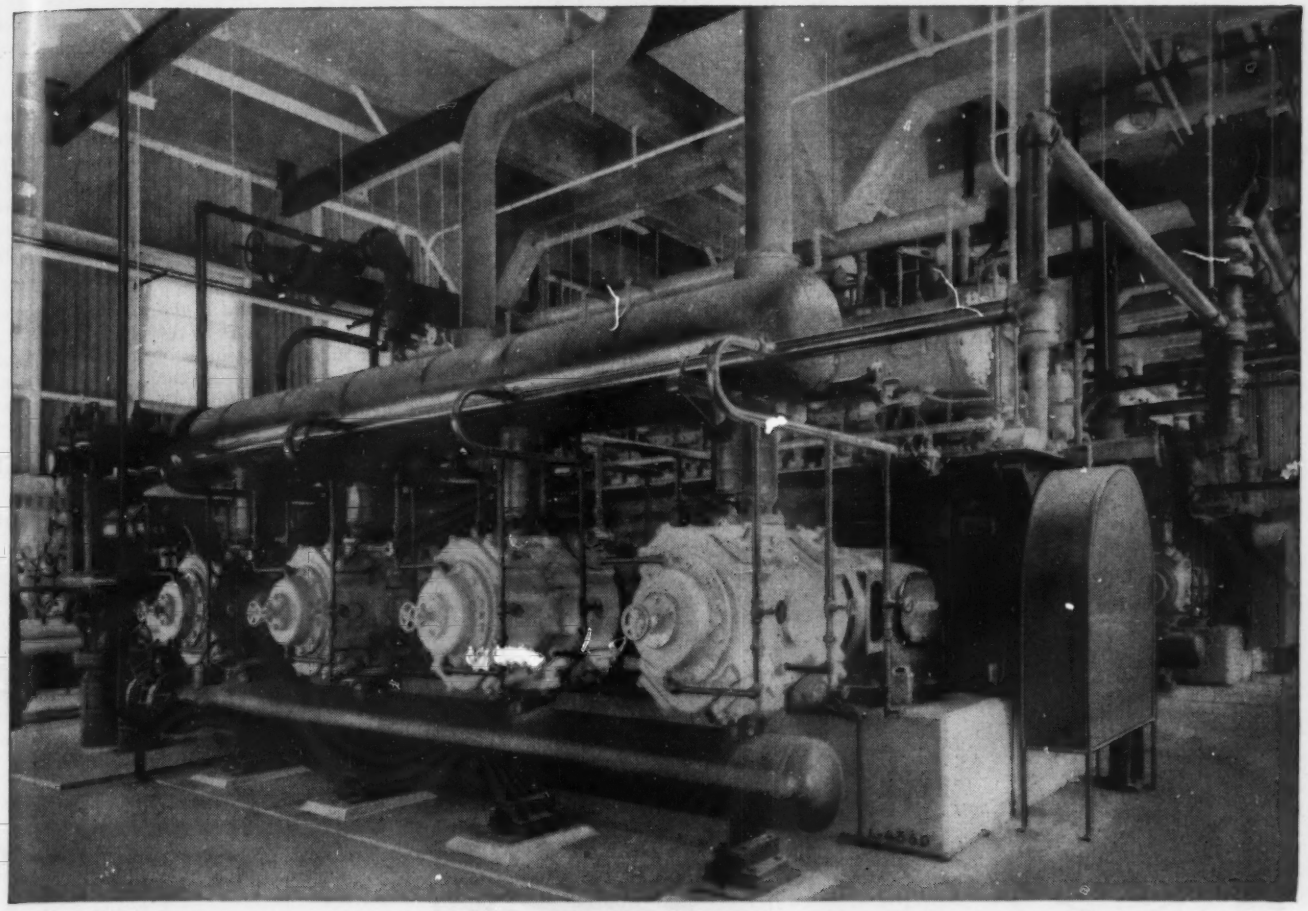
Plans also include wildcatting for additional gas in the east Ohio area, expected to cost about $277,000, and additional gas storage, costing $760,000, to be acquired near Cleveland.

Extraction Plant Under Way

A $40 million plant for new technology-chemical extractions from natural gas is nearing completion near Tuscola, Ill.

Sponsored jointly by National Distillers Products Corp. and Panhandle Eastern Pipe Line Co., the new plant is expected to produce annually 130 million gals. of L.P. gases, 6 million gals. of natural gasoline, and some 50 million gals. of other chemicals including ethyl alcohol, ether, and ethyl chloride.

While there are no definite plans for the production of other petrochemicals, raw ma-



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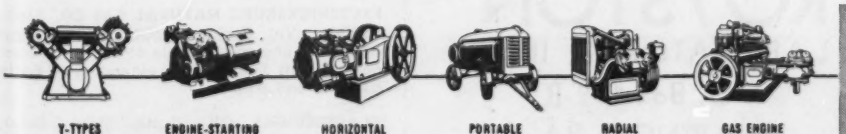

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terials will be available for the production of ammonia and related compounds used in fertilizer manufacture and of chemical intermediates used as starting point in the production of plastics and synthetic fibers.

Extraction and fractionation operations are expected to start before next March. At full operation, the plant will process about 400 MMcf of gas every 24 hours.

Pipeline Newsnotes

Arkansas-Louisiana Gas Co., Shreveport, has been granted temporary authorization by the FPC to spend $2,147,420 for construction and operation of a 7500-hp natural gas compressor station in Clark county, Ark. The station, which will be connected to the company's "Line S," will make substantially greater volumes of gas available to customers in central Arkansas. The company said the compressors will reduce peak day curtailments in Arkansas by about 40 MMcf per day.

The FPC recently authorized the Public Service Electric & Gas Co., Newark, N. J. to construct 16.13 miles of natural gas line to supply its gas works at Harrison and Jersey City from the system of Texas Eastern Transmission Corp. at Linden, N. J. Line approved for construction includes approximately 11.13 miles of 16-in. to extend from Linden to Harrison, N. J. A 2.04-mile, 12-in. line and a 2.96-mile, 10-in. line will continue from that point to Public Service's Harrison Gas Works and its West End Gas Works at Jersey City. Estimated cost of the project is $4.2 million.

FPC has authorized Cities Service Gas Co., Oklahoma City, to build new compressor facilities totaling 11,400 hp. The project calls for construction of three 1600-hp units at the company's Greensburg compressor station in Kiowa county and six 1100-hp units at a station to be located in Harvey county. The new facilities, estimated to cost $2,781,000, will increase the capacity of Cities Service's 26-in. line from the Kansas-Hugoton gas field to Kansas City, Mo. by 56 MMcf.

FPC has issued a notice that it proposes to amend the rules by revising Form No. 11, the monthly statement of operating revenue and income covering natural gas companies, to call for additional information. This would include details of operating expenses, interest charged to construction, construction in progress, materials and supplies, and volume and value of gas stored underground. The revised form would be effective for the January 1953 statement.

Texas Gas Transmission Corp. has announced the opening of an office in the Melrose building, Houston, to facilitate its gas supply activities. The company said the office represents a further move by Texas Gas to develop its program for obtaining new sources of natural gas. Fred Schall, chief geologist of the company, has been transferred there from Shreveport.

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PROGRESS REPORTS

Planned

ATLANTIC SEABOARD CORP. and **VIRGINIA GAS TRANSMISSION CORP.,** Charleston, W. Va. Docket G-2062 for 5000-hp compressor station in Braxton county, W. Va.; 6600-hp station in Upshur county, W. Va.; and 5000-hp station in Shenandoah county, Va.; supercharging 3 units from 880 hp to 1100 hp and installation of one 1100-hp unit at existing station in Hardy county, W. Va.

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL WEST UTILITY CO., Kansas City. Docket G-1682, four alternate plans to serve Clay county, Mo.

CHATTAHOOCHEE NATURAL GAS CO., Birmingham. Docket G-2066 for 70 miles of line in northwest Georgia, to connect with system of Southern Natural in Floyd county.

CONNECTICUT GAS CO., Berlin. Docket G-1954 for 3 short pipelines, totaling about 2 miles, to extend from Connecticut Light & Power gas plants to Algonquin Gas Transmission Co. from plants at Waterbury, Willimantic and Putnam, Conn.

CUMBERLAND & ALLEGHENY GAS CO., Pittsburgh. Docket G-2059 for 17 miles of line in Garrett and Allegany counties, Md. and Mineral county, W. Va. and retirement of 75 hp in compressor units at station in Preston county, W. Va.

FREDERICKSBURG NATURAL GAS CO., Fredericksburg, Va. Docket G-2041 for 28½ miles of 4¼-in. line and .72 mile of 3½-in. line connecting with Transco line, extending to Fredericksburg and area.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

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GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Point Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations.

HOME GAS CO., Pittsburgh. Docket G-2059 for 46.7-mile pipeline in Tioga and Broome counties, N. Y. and retirement of 180 hp in compressor units at a station in Broome county.

INDIANA GAS & WATER CO. INC., Indianapolis. Dockets G-1813 and G-1937, for 19 miles of 8-in. paralleling Panhandle Eastern Pipe Line's lateral between Panhandle mainline and Crawfordsville; 13 miles of 6-in. paralleling Panhandle lateral from its mainline to Lebanon; both lines to be operated by Panhandle.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Docket G-1875. To build 179 miles of line in Kansas and Nebraska and rearrange certain compressors, stub lines and metering stations to serve new mainline industrial customers; and substitution of 49 miles of 10¾-in. line for 52 miles of 8⅝-in.

LONE STAR GAS CO., Dallas. Docket G-2002 for a 2640-hp compressor station and 5 miles of 12-in. line to New York City field reservoir, Clay county, Texas.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2059 for 194 miles of line and retirement of 171 miles of line at points in Pennsylvania, West Virginia and Ohio; retirement of 440 hp in compressor units at station in Fayette county, Pa.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Docket G-2057 for 109.3 miles of 8- and 10-in. main line and 27.1 miles of lateral lines. System to connect with Panhandle Eastern Pipeline Co. line at Franklin, Mo. and extend northwest.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky communities.

NATURAL GAS CO. OF W. VA., Pittsburgh. Docket G-2059 for 7.46 miles of line and retirement of same amount in Columbiana county, Ohio.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-1999 for total of 49 miles of pipeline; 25 miles 10-in. from DeRuyther to Norwich, N. Y., 24 miles 8-in. from Norwich to Oneonta, N. Y.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 (in part) for a 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa.; contract for 29 miles of 20-in. line let to Williams-Austin Co., construction scheduled to begin Nov. 1; 75-mile line to be constructed in 1953.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2009 for a 6.5 mile 30-in. loop line from Bushton, Kan. compressor station, northeasterly to a point in Ellsworth county; a 1.4 mile 8⅝-in. branch line from its Omaha branch line to a proposed regulating station near La Platte in Sarpy county, Nebr.; a 1320-hp addition to Hugoton, Kan. compressor station.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 for 442 miles of mainline additions to connect with Permian Basin Pipe Line Co. system, and 73,600-hp in new and existing stations in Texas, Oklahoma, Kansas, Nebraska, Iowa, Minnesota and South Dakota. Also 475 miles of branch lines and additions to serve customers in Iowa, Minnesota, Nebraska and South Dakota.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 1296 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho, Oregon and British Columbia, together with laterals and four compressor stations aggregating 27,500 hp.

OHIO FUEL GAS CO., Columbus. Docket G-2013 for 34.5 miles of 20-in. loop in Ohio. Construction tentatively scheduled to begin March 15, 1953.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1384 miles main line; 316 miles of spur and lateral lines; and 8 compressor stations totaling 61,000 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area).

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for a 384-mile line from Upton county, Texas, through Lea county, N. M., north to Roosevelt county, N. M., and northeast to Carson county, Texas, connecting with facilities of Northern Natural Gas Co.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

SOUTH CAROLINA NATURAL GAS CO., Columbia, S. C. Docket G-1961 for a 160-mile pipeline in Aiken, Lexington, Richland, Orangeburg, Dorchester, Charleston, and Berkeley counties, S. C.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 339-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (partially approved). Application still open for 702.2 miles of various size pipelines and three compressor stations totaling 5150 hp in Alabama, Georgia, Mississippi.

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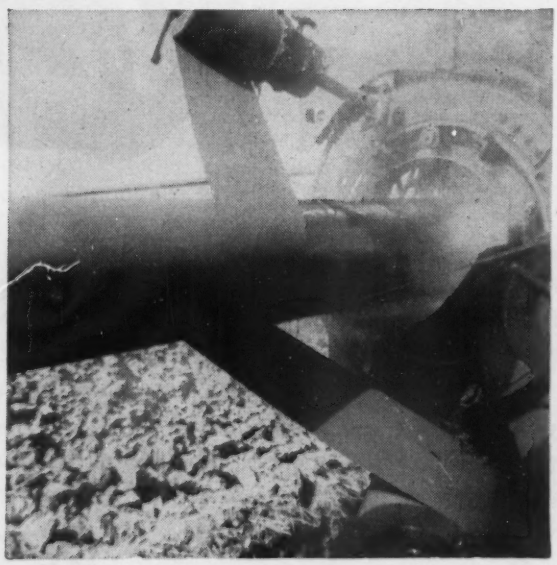

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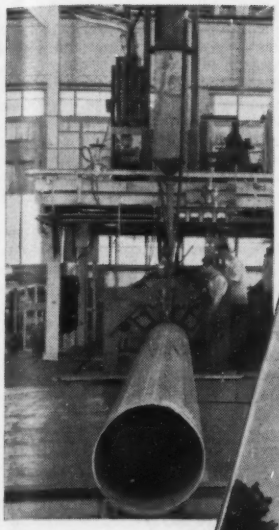

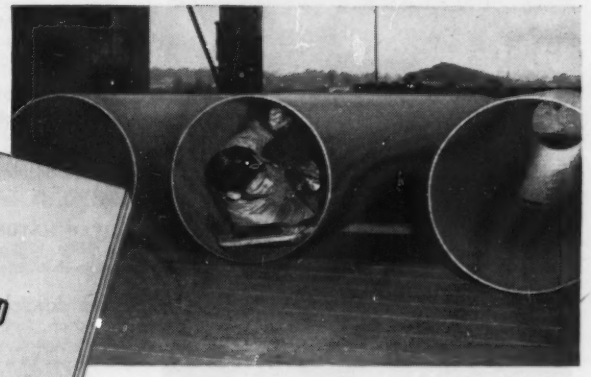

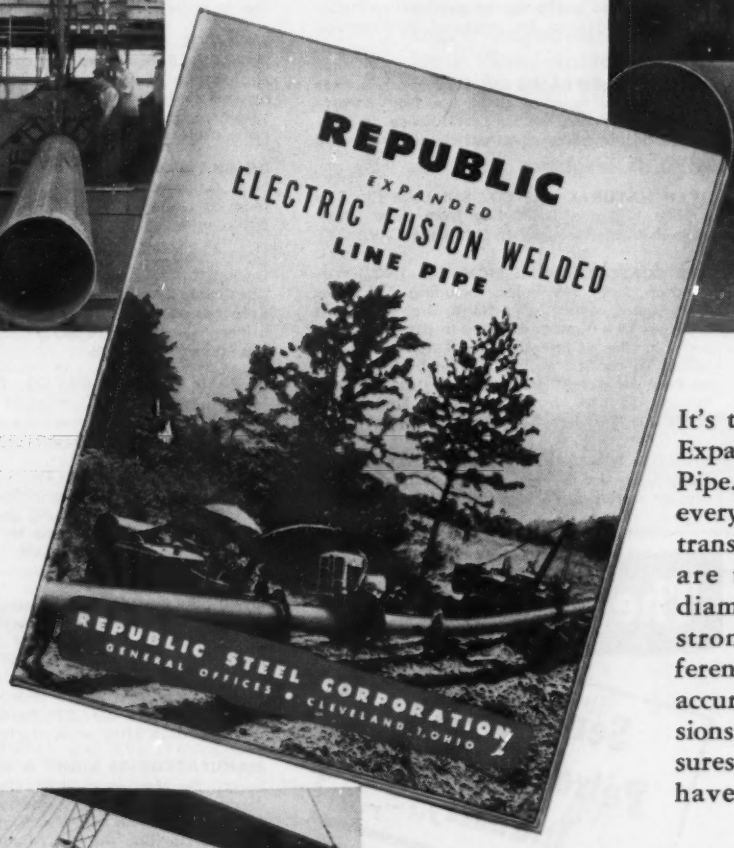

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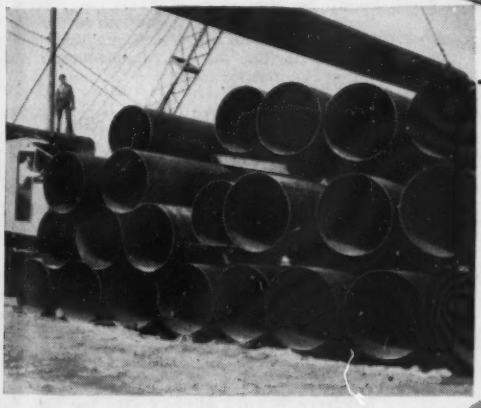

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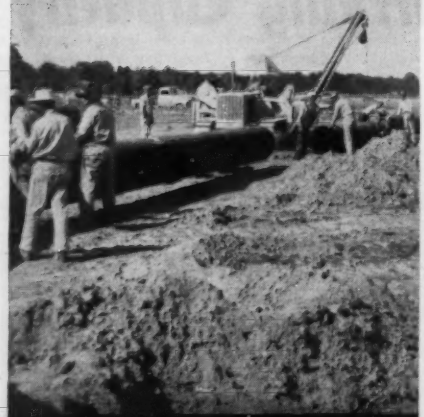

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TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1921 and G-1922 for a presidential permit to construct and operate facilities at the International Boundary north of Niagara Falls and for FPC certificate for 45 miles of 20-in. from Buffalo to Niagara; 107 miles of 26- and 30-in. loop on mainline; six new compressor stations with 80,500 hp; 51,500 hp in old stations; 50 miles of laterals; aerial suspension bridge over Niagara river.

TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

UNITED FUEL GAS CO., Charleston. Docket G-2061 for 50.5 miles of pipeline from new 2640-hp compressor station at existing storage pool in Wood county to Lanham station in Putnam county, W. Va. Also acquisition of leaseholds and authority to drill wells, install well and field lines for proposed new storage pool.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1951 for 31 miles of 20-in. line from an offshore gas field in the Gulf of Mexico to connect with line under construction in Terrebonne Parish, La.

UTAH NATURAL GAS CO., Salt Lake City. To build a 125-mile 20-in. line from Clear Creek wells in Carbon county to Salt Lake City.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 349 miles, including 277 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states, and 72 miles of laterals and 13 measuring stations. To connect with 683 mile 24-in. line to be built by parent company, Westcoast Transmission Co. Ltd., from Peace river area of Alberta and B.C. Location survey under way.

WILCOX TREND GATHERING SYSTEM INC., Dallas. Docket G-1959 for one 2200-hp compressor station and 217 miles of line in Lavaca, Jackson, Dewitt, Victoria, Bee, Goliad, Karnes, Live Oak, McMullen, and Duval counties, Texas.

Under Way

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities including 253 miles of mainline and 279 miles of laterals almost completed. Work held up pending further FPC hearings.

ARKANSAS-MISSOURI POWER CO., Blytheville. Docket G-1900 for a line from Campbell, Mo. to Blytheville, Ark., and a line from a point just west of the St. Francis river in Clay county, Ark. to Rector, Ark. The total of 140 miles of pipeline is to serve 13 communities in Arkansas and 5 in Missouri. Brown Lite Co., Tulsa, at work on 43 miles of 10-in. line from Campbell, Mo. to Blytheville, Ark. Martin Pipe-Line Const. Co., Ulysses, Kan. at work on 15 miles of 6-in. line to serve Hayti and Caruthersville, Mo.

ATLANTIC SEABOARD CORP., Charleston. Docket G-1850 for two new compressor stations aggregating 7640 hp, with 3080 hp addition to be installed in existing station, all in West Virginia. J. F. Pritchard Co. at work on all three projects.

BINGHAMTON GAS WORKS, Binghamton, N. Y. H. L. Gentry Construction Co. at work on 22½ miles of 12- and 16-in. line near Van Etten and Binghamton, N. Y.

COLORADO-WYOMING GAS CO., Denver. Docket G-1821 for 1½-mile 8-in. loop near Cheyenne; 2-mile, 8-in. replacement on Golden, Colo. lateral. Line to A.E.C. plant put in service in Nov. Remainder to be built in 1953, depending on pipe deliveries.

EL PASO NATURAL GAS CO. Dockets G-1630, G-1631 for about 170 miles of 30-in. mainline loop on existing transmission system, and about 153,000 hp in mainline and booster compressor stations.

HOME GAS CO., Pittsburgh. Docket G-1893 for 13 miles of line in Chemung and Broome counties, N. Y. Contract let to H. L. Gentry Construction Co., Jackson, Mich. Line 5% complete.

LONE STAR GAS CO., Dallas. From Garvin county, Okla. to company's Petrolia (Clay county), Texas station, 70 miles of 20-in. In partial service in Nov.; scheduled for total service in Dec. A 30-mile, 12-in. line from Miers gas field, Sutton county, to near Eldorado. Construction begun Oct. 27; to be in service in Dec., 40 days after work started.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh, Pa. Docket G-1893 (in part) for construction of 9.3 miles of line and retirement of 15 miles of line in Washington county, Pa. Contract for line work in Allegheny and Washington counties let to Britton Contracting Co.

MILWAUKEE GAS LIGHT CO., Milwaukee. Two lines, one 10 miles of 14- and 16-in. pipe extending south from Cedarburg to the Milwaukee county line and connection with the other, a 20-in. line extending east 7 miles from Menomonee Falls. Tomaro Contractors Inc. have 14- and 16-in. line nearly complete. Right of way being secured for 20-in. line.

MISSISSIPPI RIVER FUEL CORP., St. Louis. Docket G-1932 for construction of 17 compressor units, totaling 17,345 hp, in 7 existing stations in Arkansas and Missouri, and one new station in Missouri. Expected to be complete Jan. 1, 1953.

MOUNTAIN FUEL SUPPLY CO., Salt Lake City. Docket G-2003 for a 2640-hp compressor station in Uinta county, Wyo. Contracts have been let and work started.

NATURAL GAS STORAGE CO. OF ILLINOIS, Chicago. Docket G-1757 to build facilities to develop an underground storage area 15 miles from Kankakee, Ill. First stage approved, to include drilling of 25 wells; a 10,000-hp compressor station. Contract for compressor station let to Ray L. Smith & Son. To be completed by early December.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-2000 for additional 1100 hp

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at Auburn compressor station and 9.5 miles 10-in. line paralleling present line from Auburn to Seneca Falls.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh, 23-mile, 20-in. line from Tonkin station to Valley Gate, Pa.; 13-mile, 14-in. line from Aurelius to Skaneateles, N. Y. Williams-Austin Co. at work; to be completed Dec. 15.

NORTHERN NATURAL GAS CO., Omaha, has Reese Brothers Construction Co. at work on 140 miles of gathering lines in Kansas and Oklahoma to be completed by January 1953.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1618 for 213 miles of 26-in. loop lines in Texas, Oklahoma, Iowa, Kansas, Nebraska and Minnesota, and 100,160-hp additional compressor capacity.

OHIO FUEL GAS CO., Columbus. Dockets G-1911 and G-1931 for 33 miles of 20-in. to replace 42 miles of existing 8⅝- and 10¾-in. pipe in Crawford, Wyandot, and Seneca counties, Ohio, and 4 miles of 8⅝-in. pipe in Richland county. Contract let to Ohio Pipe Line Construction Co.

PANHANDLE EASTERN PIPELINE CO., Kansas City, Mo. Docket G-2037 for 6.5 miles of 6-in. line in Logan county, 13.2 miles 20-in. in Sangamon county, and a new 330-hp compressor station in Peoria county, Ill. Contract for line work let to Somerville Const. Co. To be completed early this month.

SOUTHERN CALIFORNIA GAS CO. & SOUTHERN COUNTIES GAS CO., Los Angeles. A 13-mile section of 22-in. line with Ventura river crossing to complete line from Goleta field to Los Angeles. Engineers Ltd. Pipeline Co. at work on 11½ miles of line. Macco Construction Co. at work on river crossing. Expected to be complete in December.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.,** Los Angeles. Docket G-1718 for about 20 miles of 30-in. loop line east from Whitewater, Calif., and 13,520-hp additions to compressor facilities on existing line from California-Arizona boundary to Los Angeles. Construction on compressors under way; line work scheduled to begin in December. Expected to be completed by May 1953.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1993 for a 3300-hp compressor station to be located on company's 14-in. supply line from Logansport (La.) gas field.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1676 for a total of 19,450 hp in three compressor stations in Jefferson Davis and Clarke counties, Miss. and Hale county, Ala.; 60 miles of line. Work under way on two stations; remainder complete.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (in part) for 87.8 miles of 24-in. and 4.7 miles of 14-in. loop line. Houston Contracting Co. has two spreads at work on 46 miles near Louisville, Miss., and 42 miles from Reform, Ala. to Warrior river. Miscellaneous sized lines for gathering system, 384 miles to be laid south of Gwinville, Miss.; 5400-hp compressor at Gwinville; and 3300-hp compressor station at Estopinal, La. Work started. About a 16-mile loop and submarine crossing of Etowah river.

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1930 for a 2640-hp compressor station in Carthage field, Panola county, Texas.

TEXAS GAS TRANSMISSION CORP., Owensboro. Docket G-1847 for 408 miles of 26-in. loop line in six sections paralleling its line from Bastrop, La. to a point near Louisville, with installation of 28,860 hp in compressor facilities. H. C. Price Co. Tennessee spread at work on 59-mile section; 80-mile Kentucky spread about half complete; Owensboro spread at work on 45-mile section. Construction on compressor facilities expected to be complete early this month. Entire job expected to be completed before winter.

UNITED NATURAL GAS CO., Oil City, Pa. Docket G-1854 for 15.1 miles 12-in line and replacement of 6.5 miles 8-in. line in Venango county, Pa. delayed by pipe deliveries.

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WESTERN SLOPE GAS CO., Denver, 49 miles of main transmission line and 30 miles of gathering lines to bring natural gas to Grand Junction from the Douglas Creek field, Rio Blanco county; Germesa field, Garfield county; and Highline Canal and Asbury Creek fields in Mesa county. Foutz & Bursum, Farmington, N. M. are at work on this project. Expected to be complete in fall of 1953.

Pending Construction

MIDSOUTH GAS CO., Little Rock, Ark. Dockets G-1445 and G-1680 for 191 miles of line in Greene, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, Poinsett, and Cross counties, Ark.; acquisition of 38-mile line from Texas Gas to Arkansas Power's generating station near Palestine, Ark.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 114 miles of 12¾-in. line from Topock, Ariz. to Las Vegas and Henderson areas. Construction scheduled to start about Feb. 1, 1953. H. G. Laub, pres., 7th & B St., Victorville, Calif.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 (in part) for a 20-mile, 16-in. line from Leidy compressor station, Clinton county, to Driftwood gas field, Cameron county; 970-ft, 20-in. line connecting Sabinsville compressor station to transmission line, Tioga county.

OHIO RIVER PIPELINE CORP., Indianapolis. Docket G-1847 for 13½ miles from point near Louisville, Ky. to a point near Utica, Ind.

OKLAHOMA NATURAL GAS CO., Tulsa. To build 50-mile 18-in. line from Sapulpa to Pryor, Okla. to serve chemical plant to be constructed by Deere & Co. and Grand River Dam Authority furnaces.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1651 for 86.25 miles 34-in. loop and 19,540 hp addition on existing Topock-Milpitas line.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 20 miles of 16-in. line from Burrell to a point near Easton and 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line, scheduled for construction in 1953-54.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1573 and G-1614 for 591 miles of line parallel to existing system, a 304-mile line from near Mercer, Pa. to Utica, N. Y. with a total of 165,000 hp to be installed at new and existing compressor stations. Also 250 miles of miscellaneous lines.

TEXAS EASTERN TRANSMISSION CO., Shreveport. Docket G-1947 for 315 miles of 24-in. line from a point in Lavaca county, Texas to Castor, La. Contract let to H. B. Zachary Co., San Antonio, Texas, pending approval.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1879 for compressor stations at Napoleonville and Jackson, Miss., for 13,280 total hp; and an addition of 8000 hp at authorized stations near Montpelier, La., and in Walthall county, Miss.

Approved

ARKANSAS-LOUISIANA GAS CO., Shreveport. Docket G-1979 for 6 miles of 12¾-in. line in Hot Spring county and a 7500-hp compressor station on the company's "Line S" between Waskom, Texas and Perla, Ark. Contract let to Delta Engineering Corp.

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2038 for installation of 11,400 hp compressor capacity—three 1600 hp units to be added to its Greensburg station, Kiowa county; six 1100 hp units in a new station in Harvey county.

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with about 58 miles of various sized lateral lines.

GAS

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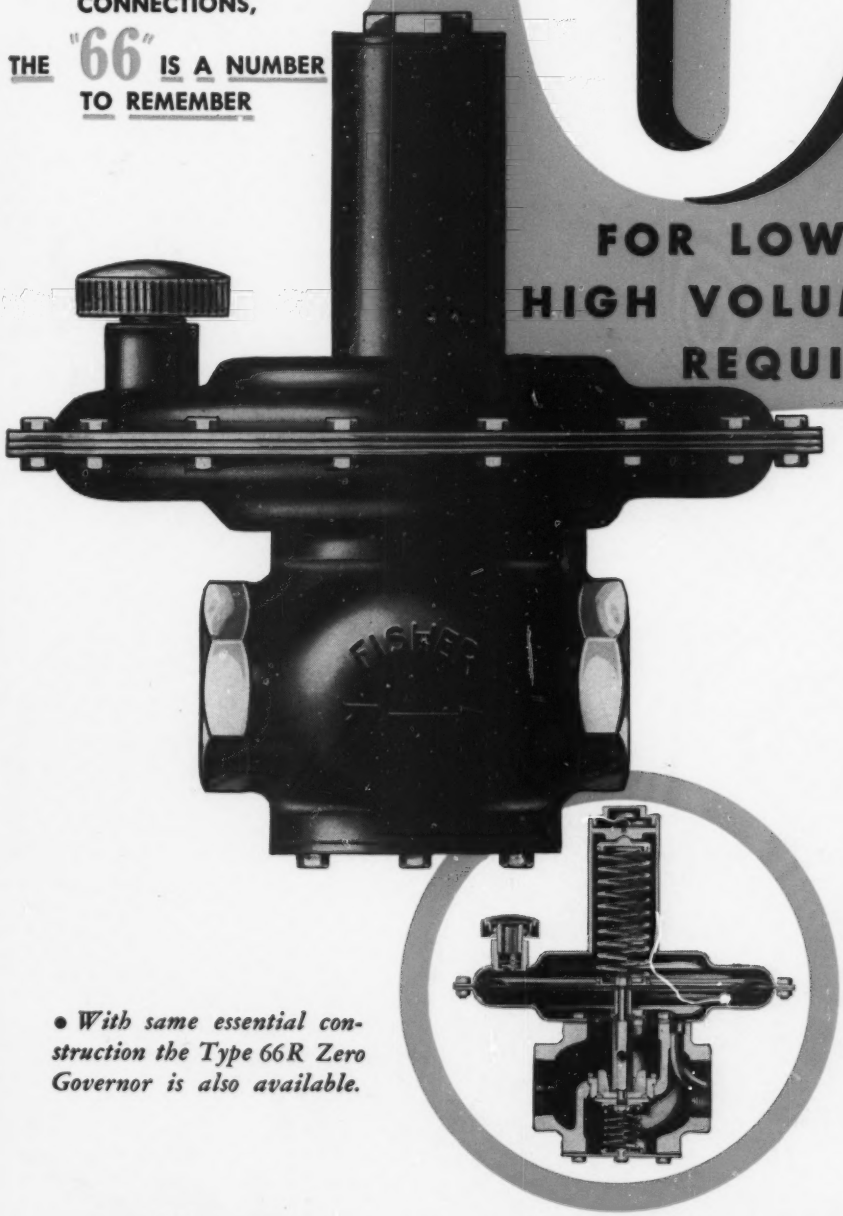

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